ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 21. No. 19. WEEKLY. | NEW YORK, SATURDAY, DECEMBER 31, 1892. | $3 per Annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

The judicial decision that it constitutes negligence to ride on the front platform of an electric car is something the significance of which should be duly grasped by the public.

Marcel Deprez, of Paris, France, has filed a bill of complaint through his attorneys, Wetmore & Jennings, of New York, against the Thomson-Houston Electric Company, in the United States Court. The complainant claims that he and Jules Carpentier, of Paris, are the inventors of a new and useful improvement in the art of transmission of electric energy to a distance. The court is asked to issue a permanent injunction against the Thomson-Houston Electric Company to prevent it from continuing a violation of their patents.

R. Baumgartner, of New Orleans, La., claims to have invented a method by which telegraph and other poles may be made to last four times as long as they do at present.

Representative A. C. Durborow, formerly the business manager of our esteemed contemporary, the *Western Electrician*, is the subject of this paragraph in the Washington *Post*:

A good story is going the rounds of the lobbies at the expense of Representative Durborow, the handsome member from Chicago. During the campaign Mr. Durborow's enthusiastic constituents had a fine lithograph of the congressman's features printed and posted on every billboard and dead wall in the city. Along came the employés of a rival bill posting concern, sticking up the name of a coming farce-comedy, and thereafter underneath every picture of Mr. Durborow's face was this line:

"INNOCENT AS A LAMB."

Mr. John W. Mackay has again sent over the commercial cables his Christmas and New Year's Greetings to the staff on the line, accompanied by a Christmas box in the shape of an order for the payment of an extra half month's salary.

C. G. Brown, an electrician of Salt Lake City, has an electrical process for reducing ore. He states that he has run through a lot of ore from the celebrated Desert mine by his process and that the return showed a saving of 99½ per cent. of the assay value of silver and gold in the ore. These are very close figures, and if facts verify these statements, and if the process is as cheap or cheaper as that now in use there can be no doubt that it is indeed a very valuable invention and should pay the inventor well.

The New York Board of Estimate and Apportionment has included in its budget for 1893 an allowance of $87,500 for 789 additional electric street lamps.

At a recent meeting of the Manchester, England, Association of Engineers, Mr. B. H. Thwaite, dealing with the effect of electric light in accelerating the action of plant life, showed the leaves of the beautiful plant the *acacia cophanta* closed in sleep—which when removed from darkness into the brilliant beam of the arc light opened almost magically, the leaves nearest the root being the first to be influenced.

A submarine electrical lamp has been tested at Toulon at a depth of 30 feet under water. It illuminated a radius of 100 feet. Fish surrounded it like insects about a lamp.

A Western paper relates an incident as seen (?) by one of its reporters. This highly imaginative writer says: "While telephone linemen were removing some old wires, one of the cut wires fell across a trolley wire. Soon after, a horse's feet became entangled in it, and the animal screamed. The driver attempted to pull away the wire and was hurled violently against the side of a house 60 feet away." It is possible that the reporter was looking through the wrong end of an opera glass.

If any one takes occasion to notice the nervous quiver of the poor country car horse, while the car is on an up grade, on the sounding of the signal bell to go ahead, there can be no doubt that he will advocate the use of the electric car system. Some of the scenes now daily witnessed are enough to make Henry Bergh turn in his grave.

The force of habit is being illustrated on many of the new rural trolley lines. The first impulse of the passenger upon entering is to drop the nickel in the box, and he walks to the front of the car, suddenly to remember that the slot business has been abandoned.

Bismarck has become an investor in American street railways, but the pursuit of money making will not interfere with the constant play of one eye on Emperor William.

A London writer, in an article relative to the cost of attending the World's Fair, says that a moderately careful man with £500, or say £600 in his pocket, ought to be able to manage fairly well a six weeks' run to Chicago and back, and perhaps even bring home a few inexpensive presents.

One of the principal advantages to be gained by the use of electricity in the operation of mine pumps is that in many mines the steam escaping from the exhaust pipes of the old pumps penetrates the roof rock, making it very brittle and therefore dangerous, while by the introduction of electricity this difficulty is avoided. As to the attention required by an electric pump, as compared with that required by a steam pump, recent experiments prove it to be much less.

The London Mint possesses an electrical machine which counts coins. It is stated that this machine will immediately detect and register counterfeit coins, and is able to do the work heretofore performed by three or four girls.

DR. CORNELIUS HERZ.

The subject of this brief sketch, Dr. Cornelius Herz, an American who has been instrumental in furthering the introduction of electric light, and who has been foremost in many projects concerning electrical enterprises in Europe, was born in Besançon, France, about 46 years ago, of German parentage. When quite a young man he came to this country, studied medicine, received a degree, and practiced as a doctor in New York city. After quite a successful practice of several years in this city he went to California, where he became interested in electrical matters. In France he had studied with Dr. Soulage, and had become a successful specialist in diseases of the mind. While in New York he married an estimable lady and later returned to Paris. On the advent of the telephone he was instrumental in introducing it into France, and acquired a considerable fortune from his connection with it.

DR. CORNELIUS HERZ.
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In 1880 he conceived the brilliant idea of having a World's Fair of Science and Art, and leading a syndicate composed of George Berger, the famous head of the last great French exposition, M. Cochery, minister of posts and telegraphs, M. Reinach, and one or two others, he organized and made a grand success of the Paris Electrical Exposition. This was famous for the introduction of the Edison electric light to scientific and industrial Europe. Here was the congress of electricians; here Herz discovered Marcel Deprez's genius, and by his energy and pertinacity enlisted numerous influential men in a great electrical syndicate with many millions of capital, and the control of which, later, passed into the hands of the Rothschilds, where it now remains.

One of Dr. Herz's greatest services to electrical science was the founding of the electrical journal *La Lumiere Electrique*, one of the ablest and most scientific of the foreign electrical journals. His sagacity and editorial ability was proven during the electrical exposition by the appearance in his journal of a series of magnificently illustrated articles written for him by the celebrated Count du Moncel, and a large and able corps of brilliant scientists. These articles were the feature of the exposition, as may be judged from the fact that one whole number, from title page to finis, was exclusively devoted to the Edison exhibit. Another whole number was given up to Deprez in a classic article on the "Transmission of Force to a Distance," and on his "characteristic" of the dynamo machine. Subsequently the great experiments by Deprez on the transmission of several hundred horse-power over a great distance were conducted under Herz's guidance. These celebrated experiments were the foundation of many others, which realized a fortune for Dr. Herz. This accumulated wealth he has used liberally, as numerous Americans can testify who have visited Paris in connection with electrical matters.

Dr. Herz is not only devoted to electrical science, literature and industry, but he is well known for his great taste in the art of music and painting. His immensely valuable collection of the modern masters in his magnificent residence in Paris, has been enjoyed by many who have been fortunate enough to be received in his hospitable home.

The influence that he has had with those high in many circles of life has shown him to be a man of great ambitions and indomitable energy. The introduction of the electric light and the numerous applications of electricity, as exhibited in the French exposition of 1880, would not have been as successful as they were, had the manufacturers and inventors, who occupied space in the Palais de L'Industrie, not been represented by competent and progressive men. Dr. Cornelius Herz did a great deal at that time to further all interests represented, and their following successes are due in a great measure to him.

Dr. Herz has had conferred upon him at various stages of his life all the honors which France can bestow upon a successful man, and he is now a Grand Officer of the Cordon of the Legion of Honor.

A Storage Battery Experiment on Ninth Avenue.

An electric car equipped according to the system of the Acme Storage Battery Company, of this city, is now being operated experimentally on the tracks of the Ninth Avenue Street Railroad. This car weighs 6¼ tons and is provided with 144 cells, each weighing 27 pounds and having a capacity of 140 ampere hours at an average discharge rate of 25 amperes. The grades on the Ninth Avenue Road, from 54th street to 116th street, a distance of three miles, are exceedingly heavy, one of them, at the end of the route, being no less than six per cent. for a distance of more than 200 feet. On the up-trip 31 amperes are usually consumed; a capacity of 75 amperes may be called upon at any time.

The time usually occupied on the up-trip is 24 minutes and 50 seconds. On the return trip, during which the grades are mostly descending, the average current drawn from the battery is 19 amperes, or little more than half of that required on the up-trip. The average time of the down-trip is about 22 minutes and 30 seconds. The entire trip both ways has been made in 47 minutes and 20 seconds. A specially designed motor, the company alleges, is one of the features of this system. The aim has been to make a cell which, while having the least weight for its storage capacity, shall at the same time be so constructed as to avoid the deteriorating influences which have usually caused the rapid destruction of storage cells employed in this class of work. The car made one trip last week when the tracks were in a wet and slushy condition. A fair speed was made and maintained on all the grades. The company manufacturing this system claim that they can run their cars at a cost of only nine cents a mile.

Micanite and Its Application to Armature Insulation.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, DECEMBER 21, 1892, BY EDWARD P. THOMPSON, M. E., FOR CHARLES W. JEFFERSON AND ARTHUR H. S. DYER.

An armature and its commutator consist of the combination of two elements; namely, electric and magnetic conductors and insulators. In the earlier days of armatures, the electrical and mechanical dimensions and proportions of the conductors were considered of prime importance. The first armatures were small and the electromotive force low, and consequently little attention, comparatively, was given to the element, insulation. Lately, simply paper, cloth, convolutions of ligatures, or these materials impregnated with shellac or similar insulating varnish or paint, were employed for the purpose of preventing leakage or short-circuit. To remove the solvent of the shellac, the armatures were baked for 24 hours. Judging from the variety of materials used at present, and the changes from one material to another, it would seem that the insulators are now receiving their share of consideration, while the core, wires, commutator-sections and other conducting portions are secondary details. Why so much difficulty with armature insulators and so little with other insulators, such as line insulators? Because, in the former, not only must the material be of extremely high resistance, but also unaltered under the effects of heat, and must be crowded into very small quarters. Space must be economized. If the electric current or heat alone were present, and if space were not so much limited, the problem would be easily solved. It yet remains to be proved that any known substance is absolutely a non-conductor—nor is the resistance of a given conductor constant. Unfortunately for the armature constructor, the worse the conductor, the less the resistance with increase of temperature. An extra current is produced in metals upon variations of current. A diminishing of current occurs when first entering a substance of high resistance. Finally and gradually the current becomes constant. This action for convenience is often called polarization. As this property is noticeable only in long lengths of the insulating material, it has little bearing upon any of the armature elements other than in connection with the covering of the wires. The substance possessing the property of polarization in a marked degree is gutta-percha.

Paper or fabrics by themselves should never be used as an insulator, because when moist they conduct a current so well that they may properly be termed semi-conductors. A coating of shellac or oil on almost any substance enormously increases its resistance, and protects porous and deliquescent substances from water. Paper thus covered serves, with machines of low electromotive force, the purpose of preventing leakage, but, by no means perfectly in practice, with large machines. Its advantages are more in the nature of convenience and cheapness than of efficiency.

Paper which has been thoroughly dried is of very much higher resistance—so high that it falls under the head of non-conductors, and, therefore, the shellacs should not be applied until after the paper has been subjected to a thorough drying process.

It is a peculiar property that a given substance in a compact condition is of very marked higher resistance than when powdered or comminuted; for example, pulverized glass is a semi-conductor, while sheet glass is as high in resistance as silk. This property has been noticeable in armature practice. If the insulating material is cracked here and there, it is unfit for armature use. The cracks are in nature of interstices between the particles of a powder, and at the cracks the material is in part ground. The explanation may lie in the distinction that the pulverized material has more surface, or that damp air exists in the spaces between the particles, or that a spark can traverse a gas better than a solid, or that each particle becomes coated with a film of moisture. The last seems the most probable, because the best surface concentrators of water usually exhibit the property most strongly.

The locations of insulation in an armature are between the armature disks to prevent eddy and foucault currents; between the core and the windings to prevent the current from short-circuiting the coils through the core and burning out the armature; between the commutator-sections to prevent leakage from one coil to another; over projections or in grooves in the core; and around the wire to guide the current in convolutions. All these parts, even in the best made armatures, become more or less abnormally hot. Means have been planned and sometimes put into practice for cooling the parts, and thereby saving the insulation. One method consists in constructing the armature after the style of a fan or with large radiating surface; another in equipping a device to blow out the sparks of the commutator, and again, in using cooling insulating liquids. With whatever precautionary means the machine is equipped, the parts either accidentally or through inefficiency of means, will become abnormally hot. The machine will be injured if combustible materials form the bulk of the insulator. The materials of an ideal armature consist of copper, iron, and a heat-proof and water-proof non-conductor. If the material is combustible, or altered in its chemical nature by heat, its resistance is changed and generally lowered. Manufacturers of incandescent lamp filaments know that complete carbonization cannot take place except at a very high temperature, like 3,000 degrees Fahrenheit. An armature may rise to 500 degrees. At this temperature, easily carbonizable materials, such as linen, cotton and other forms of cellulose are weakened, blackened and the resistance reduced. Shellac, although blackened at this temperature, is converted into those compounds whose resistance is not lowered. Shellac forms an exception, therefore, in being charred by such a temperature without reduction of resistance.

There is a greater detriment than chemical change by heat. The material cracks, becomes somewhat comminuted, and the resistances, both mechanical and electrical, are therefore greatly reduced. If paper or cloth, or even shellac is depended upon as the insulating material rather than as the binding material, it is not electric proof; because, principally, it becomes, when charred, fractured at numerous points, if not completely pulverized. As to why shellac is not appreciably lowered in resistance by partial carbonization may be because it is an animal substance.

One of the most important attributes of an armature should be its rigidity. It should be like a rock in this particular. If the insulation should consist of a soluble material, for example, and the same dissolved out after the completion of the armature; or of some material that would be reduced in size by heat; then the wire and bolts would soon become loose from the rapid rotation and vibration, and finally the armature would be useless. Change in volume of the insulators has caused nine-tenths of the armature breakdowns.

In the matter of insulation between the disks, it was found that oxidized or rusted laminated armature disks would insulate without any addition of paper or similar insulating films. The only difficulty with such a construction is one of degree. Iron rust insulates, and it is heat-proof; but it does not insulate sufficiently to compensate in most instances for its simplicity and cheapness, and, besides, it is not applicable to any other part of the armature than between the laminæ of the core. The great advantage lies in the extreme thinness of the oxide coating, whereby a large amount of iron is obtained in the core. A modification has been suggested, which consists in placing thin mica sheets between every half-dozen of the disks. Again, iron wire, or ribbon rusted has been employed for armature cores. The wire or ribbon is formed into a ring, around which is the electric conductor. Another modification consists in "case-hardening" the iron, and also in japanning the surface. As to commutator insulation, natural mica sheets have been almost universally employed.

If it were not for the matter of mechanical construction and heat, shellaced glass would make a good armature insulator. It could be molded into any form and made of any degree of thinness. Its objections, however, are well known. Very gradually, and more so than would be conjectured, mica made its appearance in armatures. The introduction of mica into practice appears to have been brought about in the following manner: An accident would happen to an armature, and before the next night it must needs be repaired. In order to make the temporary remedy, mica sheets or bars would be interposed. In the case of subsequent accidents, the portion repaired by mica was the last to yield. Therefore it was proposed to build the armature primarily with mica. But this change took place very, very gradually, but surely. Manufacturers of stoves, the leading houses being also importers of mica, soon experienced a growth in the mica department of their business, until at present some import more for the electrical industry, especially for armature use, than for stoves. Why it was not employed from the first, no one could positively assert, otherwise than to guess, that no one probably thought of it, or insulation was not considered of much comparative importance, or cheapness of material in construction was allowed to counterbalance efficiency of action and durability.

Of all substances, mica probably is the best material for use in armatures, if it is desired to obtain not only efficient electric insulation, but also durability under the influence of heat. The highest temperature to which an armature is subjected, even by short circuit or bad construction, will have no injurious effect upon mica. Mica, thick or thin, may be held in a gas flame without cracking, burning or melting. It remains unaffected. The reason of this is better understood when it is remembered that it consists of aluminic silicate, containing also potassic, sodic and lithic silicates, and some ferrous and ferric and manganic oxides. Its chemical constitution varies.

One quality of mica is that which is commercially termed amber mica, and is usually mined in Canada. It is so named from its appearance, and not because it is amber or in any other way similar to it than in its color. India mica is a commercial form noted for its uniform cleavage, great thinness of its laminæ, flexibility without fracture and its resistance, which is much higher than that of amber. Carolina mica is another variety. It is obtained in sheets in the western part of North Carolina. It is the best mica for stoves, but it is too hard for electrical purposes. Mica occurs in so many specific forms that particular names have been given to it.

Muscovite is one of the most common varieties. It occurs in different colors, namely, a dark green, yellow, brown, white and gray. This is the form usually found in small scales in granite, gneiss, and mica schist, and at the same time it occurs in larger, tougher sheets than any other form. A complete scale is irregularly hexagonal in shape. Lepidolite, or lithia mica, has a pearly lustre, as distinguished from the vitreous lustre of muscovite. Its scales are usually very small, and it is found in limited varieties of granite and gneiss. Cryopholite is a subvariety of lepidolite. A characteristic feature of the form meionite consists in its occurring much cracked within. It has been found in geodes. Biotite is a form found in volcanic rocks in small scales. It contains much iron and magnesia compounds. Phlogopite occurs usually in limestone. Its subvarieties are aspidolite and manganophyllite. A very brittle variety is lepidomelane. It is also practically opaque. Its sub-variety is astrophyllite.

The insulating power of mica is superior to that of any other substance applicable to armatures. An advantage, peculiar to itself, is its even, laminated structure. How wonderful is the thinness of its individual layers! A piece of ordinary writing paper is about .005 inch. Mica layers have been obtained of a thinness of .00003 inch. Mechanical difficulties prevent its being split thinner. By pasting it upon a hard surface and splitting it off as much as possible, the remaining fragments are so thin as to become beautifully iridescent. The builder of armatures can therefore split the sheets into any desired and uniform thickness with great ease and accuracy. An interesting property of mica, and one not generally recognized, is its homogeneity of structure and clear transparency, although so black when thick. The writer used a piece one-quarter of an inch thick for observing the late solar eclipse. The effect was better than with smoked glass and as efficient as black glass much thicker.

A valuable property of mica in connection with commutator insulation is its proper degree of hardness, whereby it does not wear away too rapidly under the action of the brushes. If rubber were used, for example, even if it did not burn, yet it would wear off and sparking result, because the commutator surface would not be truly cylindrical. The brushes would be set into vibration. Again, mica is capable of the finest pulverization, so that any wearing which does take place does not result in the liberation of gritty particles, which would also cause sparking. Such mishaps occur with hardened artificial plastic insulators. The insulation should be just so thick that the current cannot jump across from one section to the other.

Although so superior for armature insulation, mica is, in its natural structure, accompanied by certain objections, which, in trying to overcome, were more serious than had been anticipated, as it was not until after a long series of trials that a successful article was produced, and not until a novel apparatus for cheapening the process of manufacture was devised. The apparatus is now in operation on a large scale. The description at present is confined, however, to the article, and to full information of its structure, manner of using and properties.

The objections alluded to are: Mica, as found in nature, occurs in flat sheets only. It has a high degree of elasticity, so that when once bent and released, it assumes its original form. If folded, its brittleness causes fracture. If the natural sheets are compressed in a mold, to try to form armature insulator heads for instance, it is completely broken up.

Secondly, natural mica sheets correspond financially to plate glass. The larger the sheet, the higher the cost per square inch. Mica in small pieces, from four to six square inches, is exceedingly abundant and very cheap. It is often called waste mica, because very limited in its uses, and consisting often of trimmings from larger and more useful sheets. In medium and large sizes of armature, the naturally built up mica is so expensive as to be objectionable, although not so much so as to entirely prevent its employment.

Thirdly, between the hundreds, nay, thousands, of thin layers, damp air can enter, and also water, accidentally, which cannot easily or effectually be removed.

Fourthly, mica splits so easily that handling causes injury.

Fifthly, mica cannot be cut transversely to advantage. The edges are unworkmanlike, being ragged and jagged. Neatness in drilling, sawing and turning is difficult.

Among the attempts which have been made to overcome these objections are those involving the use of pulverized or comminuted mica, which is mixed with a liquid cement and stirred into a paste. While still soft, the mixture is rolled or compressed into any desired form, as if consisting of so much plaster-of-paris. In order to give it sufficient strength, one-third

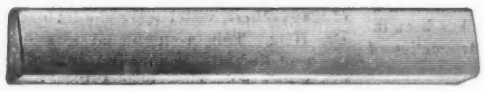


FIG. 1.—MICANITE TUBE FOR INSULATING CORE PROJECTIONS.

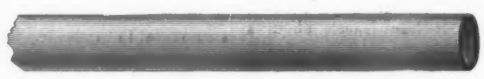


FIG. 2.—MICANITE TUBE.

FIG. 3.—MICANITE ARMATURE SLOT INSULATOR.

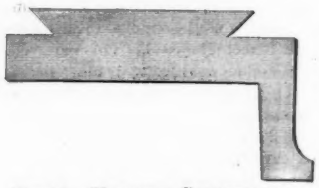


FIG. 4.—MICANITE COMMUTATOR SEGMENT INSULATOR.

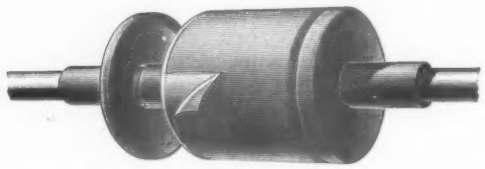


FIG. 5.—COMPLETE DRUM ARMATURE CORE PROTECTED WITH MICANITE.

FIG. 6.—MICANITE RING FOR ARMATURE.

FIG. 7.—MICANITE WASHER.

of the product is cement. The mica sparkles here and there on the surface, as it glitters on granite. This article should be called a cement insulator, and not a mica insulator, because the current can flow in a straight circuit through the plate without encountering any mica. The cement forms numerous rectilinear paths for the current independently of the mica; and therefore the product in no sense is an equivalent of mica.

A modification of this type of insulator consists of a coarse and thick textile fabric, whose pores and meshes are filled with a mixture composed of comminuted mica and a suitable adhesive substance. Another consists of finely divided asbestos mixed with pulverized mica, silicate of soda and sulphur compounds. It is molded by pressure into any desired form.

The comminuted mica cement type is useful in trolley wire supports and similar insulators, but for dynamos it is useless, not only for the reason stated, but because of its softening and running under slight heat, being so necessarily rich in cement. If the cement is that kind that chars, the mica crumbles apart. Mineral powders have been mixed with it, to render it more fireproof.

An example of the manner of using non-comminuted mica between the core and the windings consists in covering the core with paper, laying sheets of mica over the paper, then laying on another sheet of paper, fastening the whole together by convolutions of cord or similar ligatures, and finally applying the coils. During operation, the paper and mica may shift from their positions, and thereby affect the rigidity of the armature as a whole. Again, the process of applying the pieces, and keeping them temporarily in position, requires repeated efforts and results in a display of crude workmanship.

The exhibits before you show practical results of work carried on for the purpose of overcoming the objections named.

Large Plates.—One of these plates is a yard square and .035 inch thick. Another is of the same size and 1 inch thick, and another about 4 x 12 inches and 1 inch thick. They have nothing to do directly with the armature, but could serve as foundation plates for a dynamo or motor. They are practically all mica. A *natural* plate of mica of the larger size would be a curiosity—a rarity. Any of the sheets may be cut up into any desired size and shape. The layers cling together much more tenaciously than in the natural plate. The path of least resistance from one side of the plate to the other is in a straight line, and a straight line intersects numerous mica sheets, and, therefore, the article is a mica insulator and not a cement insulator. These plates are made by such steps and apparatus that, when subjected to heat in the armature, no injury whatever is produced.

Further, they are superior to a sheet of mica as it comes from the quarry, in that they do not absorb water or damp air; in that they are stronger to resist either pressure or tension; in that they may be neatly and easily sawed and drilled; in that they are enormously less costly, and in that they are of about the same resistance. By picking the exhibit apart you can easily learn the structure. The mica of which it is composed is non-comminuted, but the pieces are exceedingly thin. The thickness is, by measurement, about .001 inch, *i. e.*, about as thin as tissue paper. The sizes vary from two to six or eight square inches. In each layer of mica you may notice that the sheets overlap at their edges, and the cement between the layers is hardly noticeable. The former mentioned plate weighs four pounds, and the latter over 100 pounds. It is a convenient quality in connection with mica that it can be split into pieces of the thickness required for the particular device under the process of construction. This property is also possessed by the plates exhibited. A thin and long knife may be caused to force its way in any of the many planes parallel to the surface, for the purpose of reducing the thickness or obtaining several thinner sheets from one thick plate.

Some tests were carried on to determine the relative values of these plates, and plates of comminuted mica and cement. Using the words of the electrician who originated and performed the tests, he says: "For the purpose of insulating armatures, any solid insulating material should possess considerable strength and should maintain its strength when submitted to a moderate degree of heat. One piece tested consists of ground mica and shellac, mixed together and rolled or pressed between plates to a uniform thickness. In order to test it, I placed it upon a steam table and left it for a minute, at the end of which period I tested its strength by pressing the end of a piece of wire against its surface with very light pressure. The end of the wire, which was blunt and made of copper, easily pushed its way through the sheet and left a hole when removed. In removing the sheet from the steam table it warped. The second plate consists of layers of sheets of mica, cemented together with overlapping joints. This sheet I placed on the same steam table used for the other sheet, and after one minute had elapsed, tried to thrust the same piece of copper wire through the plate, but without success, though exerting all the strength that could be brought to bear upon it by my hand. After the sheet had been on the steam table for five minutes, I placed it on a thick iron plate, laid a piece of the same copper wire upon its upper surface, put a second sheet of wrought iron on top of it, and put the whole into a hydraulic press. It was then submitted to a pressure of 2,000 pounds per square inch for one minute, and the result was the flattening of the wire and a very slight crumpling of the mica sheet on the opposite side. The plate was then placed between two copper plates, and a weight of about four pounds placed on the upper plate. The insulation resistance of the plate was then tested and found to be 25,500 megohms. I have used similar plates, similarly prepared, in motors, upon which a load of 50 horse-power has been placed, the entire thrust of the motor being received by the plates, which in this case were less than one-sixteenth of an inch thick. The temperature was brought up to 650 degrees Fahrenheit, sufficient to burn cotton and melt hard solder without injuring the insulation."

Curved Specimens.—Similar remarks substantially may be made about these as about the large plates. Natural mica plates could never be given a permanent set, or molded into curved forms. The armature head consists essentially of an annular disk, provided with flanges around one or both peripheries. It is in one sense a continuous piece. The flanges, you may notice, are made separably and then fastened to the disks. There are no joints. Some of the pieces of mica, sometimes called waste mica; also, you will find similar pieces split as fine as possible. These are the result of the first operation. The next step consists in putting them together in the manner shown in the exhibits; that is, in layers with overlapping edges. Between them are layers of a cement having those qualities which fit the product for the purpose intended. Until only recently these pieces were always laid on by hand. Their manufacture required one factory girl per cubic foot per hour. Now, one girl can do the work which formerly required 20. The girl feeds the machine, and it does the rest. The amount of cement employed is practically infinitesimal, because while in a plastic condition, the mass is subjected to such pressure that a mere trace remains, and yet sufficient to obtain proper adhesive qualities. From the beginning to the present, improved processes and new machinery have been required.

Dr. James Bowstead Williams has carried on a long series of tests upon the comparative specific resistance of mica and micanite. The data and results are as follows:

Th conditions of the tests were absolutely the same in all cases. The potential was constant, being over 3,000 volts. A dynamometer served to maintain the same pressure for different materials. All the samples were kept at the same temperature and under the same hygroscopic conditions for several days. Samples were of uniform thickness. The best samples of micanite gave approximately the same reading as the best India mica, indicating that the resistance of micanite is equal to that of the best commercial mica.

I will close this paper by presenting cer-

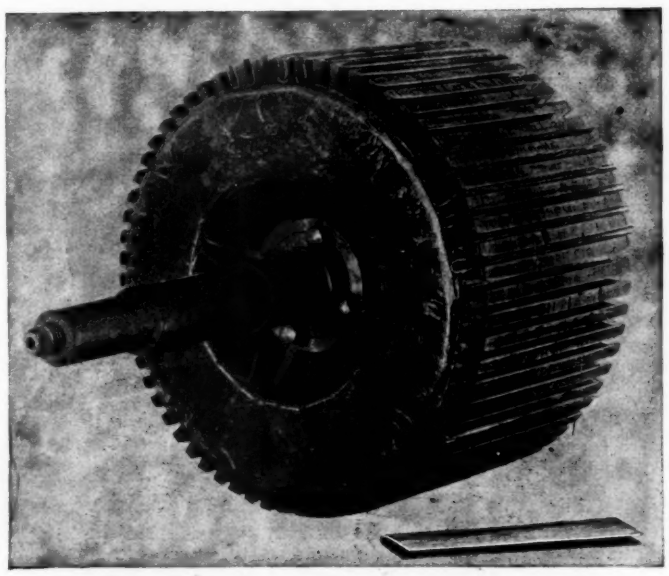


FIG. 8.—W. P. ARMATURE CORE SHOWING APPLICATION OF MICANITE SLOT INSULATORS AND ANNULAR HANGED MICANITE HEAD.

peculiarly curved forms are furnished in order to illustrate that the article may be manufactured in any imaginable form of uniform structure, and in single pieces of uniform properties throughout.

Tubes.—In order to show the unlimited forms into which the material may be molded, a tube several feet long is exhibited. It may be cut up for use in certain types of armature, or when long, for use on board ship, and in general interior conduit installations.

Stamped Forms.—The flat pieces of peculiar form could be made from the beginning in individual pieces, but it is much cheaper, if stamped from larger plates. Before using the large plates for any purpose where an exact thickness is required, they are burnished or surfaced off by machinery. Some of the plates before you are in a crude state, and little scales here and there can be peeled off. The others are so different as to resemble a metallic surface, and, when struck, ring like metal. Some of the forms are for large commutators. Others are flat rings for field-magnet cores. The very irregular flat pieces are for certain types of commutators. On account of the almost metallic qualities the product can appropriately be termed an "insulating metal." For convenience, it is called micanite.

Commutators.—In equipping a commutator with this material, it is necessary to know something which has been learned by early users, only through experience. The insulating and metal sections are put together in the usual manner, and the whole is heated to a temperature higher than that which it will reach in actual practice. While still hot, the elements are clamped tightly together.

Among the exhibits is a mass of odd tain topics which appear to be suitable for discussion, but which need not be adhered to. I hope you will discuss among yourselves as much as possible.

SUGGESTIVE TOPICS.

Armature.—Rigidity and its dependence upon insulating material employed.—What has been learned by observation and special tests?

Preservation of Insulation.—Is it better to try to remove the cause of heating, or to neutralize the heat?

Burning Out Armatures.—What does insulation have to do with it, and what are the remedies? Also, what are the causes?

Durability of Insulation.—Differences in connection with armatures for inside use, such as installations, and outside, *i. e.*, railway, mining and elevator use. Effects of atmosphere, motion and rough treatment.

Financial.—Does the expense of insulation, if the best, have an appreciable effect upon the cost of construction, and on the other hand, will it pay in the end to put in a cheaper material?

Comparative Merits of Insulating Materials for Different Conditions.—Effects of high potential. Power to resist spark puncturing. What have tests shown as to properties of materials to withstand "break-downs," independently of high ohmic resistance?

Big Trust Mortgage.

The Brush Electric Company, of Cleveland, O., gives a deed of trust to the Old Colony Trust Company, trustee, to secure $500,000 worth of 6 per cent. bonds, dated May 1, 1891, and payable May 1, 1921. The paper has been filed in the recorder's office. It is the old matter of issuing bonds to satisfy the minority stockholders who were not pleased when the sale was made of the interest of Brush stock to Thomson-Houston people.

The Postal Telegraph line from Athens to Vicksburg, Mich., is being taken down and a telephone line substituted.

ELECTRIC RAILWAY AND POWER NOTES.

The residents of Chicago, on Forty-seventh street, expect to have a trolley line pass their doors.

The electric railway seems bound to have a rapid development, no matter how many try to obstruct its progress.

The City Council of Oakland, Cal., have declared that all trolley poles erected within the city limits must be of iron.

The Union Railroad Company, of Providence, R. I., will soon erect a power plant on Eddy street, to supply the trolley lines soon to be constructed.

Mayor Sargent, of New Haven, Conn., has signed the order allowing the State Street Horse Railroad Company to electrically equip their road and the Whitney avenue route.

It is reported that the stock of the Globe Street Railway, of Fall River, Mass., is now valued by its owners at 400 per share, or just double what the syndicate paid for it a year ago.

The Taunton, Mass., Electric Lighting Company is making preparations for largely increased facilities, and by spring it is expected that all the new appliances will be ready for use.

The Chester, Pa., Electric Light and Power Company withdrew their injunction against the Union Railway Company, the difficulties between the two corporations having been satisfactorily adjusted.

The test of the electric crane which is being set up at the Portland, Me., Company's boiler shop will be delayed, the truss rods being too low to allow the passage of the crane. The Giant Electric Motor Company set the overhead wires from the dynamo room to the boiler shop.

The Binghamton Railroad Company, of Binghamton, N. Y., will soon place on the market $600,000 of first mortgage five per cent. gold bonds, which, under the showing made in a recently issued prospectus, should prove a good investment for capitalists who appreciate the value of electric railway securities.

The other day a locomotive drawing three coaches covered a mile in 37 seconds. This means that 97 miles will be traveled in one hour. After this feat, it would be well for the wise ones to stop and consider before they shake their heads and declare that 100 miles an hour on the electric road is impossible. We may not be ready for it yet, but might as well be on the watch.

The Jefferson Avenue Electric Railway bill of St. Louis, Mo., will be reported to the city council with the indorsement of the committee to which it was referred last August. The bill provides for the substitution of electric motors for the old car horse which has disgraced the city so long, and grants the company a 20-year extension of its franchise from 1912, the date of its present 30-year franchise.

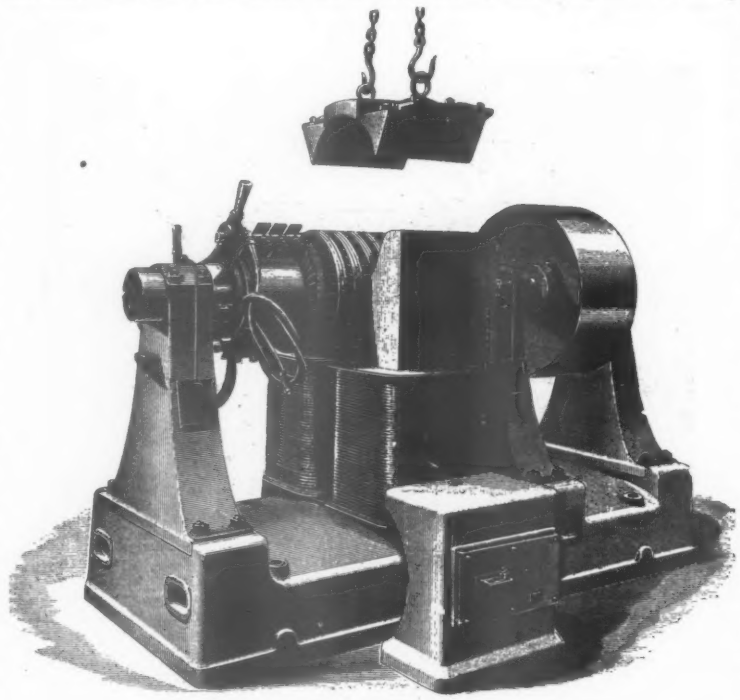
The location of Fort Thomas on the Highlands, above Newport, is almost inaccessible to wagons carrying heavy freight. The company building the electric road to Fort Thomas will lay an additional rail along the route, to provide a suitable gauge for the transferring along this track of C. & O. freight car. A motor car will be specially equipped with a 200 horse-power motor, and this will be used in hauling cars of freight from Newport up the hill to the fort.

Mr. P. F. Morey, president of the Portland General Electric Company, and Mr. W. C. Cheney, electrician of the company, will close contracts for the electrical and mechanical plant required for the immense power station to be built on the west side of the river, at Oregon City, for supplying electricity for lighting and power purposes in Portland. The company will expend on this station about $1,500,000, and it will be the most extensive affair of the kind in the United States.

Steps in the Electrical Progress of 1892.

The marked success of the experimental test in Germany of long distance power transmission by means of high tension alternating currents has added a new stimulus to progress in alternating current motors, and during the past year a number of types have been brought out, some of which aim at the solution of the problem of distribution of alternating currents by producing a motor designed to work with a simple alternating current, and others of which are of a polyphase character, provided with a closed circuit armature, such as were used in the Frankfort plant. It seems that some form of efficient alternating current motor is necessary for the utilization of power when transmitted over long distances. Direct current transmission, as the art now stands, is barred, owing to danger to the insulation and commutators if high tension be used, and is barred by the excessive cost of the conducting mains, if a low tension be relied upon. In the experiments in Germany an efficiency of 74 per cent. between the axle of the turbine and the motor was realized. This, however, did not take into consideration losses in the motor. The latter, however, was very efficient, though probably did not realize as high an efficiency as is possible with synchronous motors. The losses in the transformers were very slight, and the line loss was only 6 per cent. for a distance of 110 miles. These favorable circumstances marked out the alternating current as the agency *par excellence* for distribution at long distances. One of the types of motor developed during the past year was the Stanley-Kelly motor, which is designed to be operated by a single-phase alternating current, the lag due to self-induction being taken out of the field-magnet by means of condensers, which have the property of giving a lead, and thus the lag created by self-induction in the field-magnet is counteracted. These motors have not yet gone into practical use, but if the promises made by their promotors are realized, they will doubtless meet with a large share of success. Other types of alternating current motors have been developed during the past year by Bradley and others, who were early at work in this field. Mr. Bradley is one of the pioneers in the art of triphase transmission, which was the type of system adopted in Germany. It is probable that the polyphase system of transmission and some form of polyphase motor will be adopted in the plant now in course of construction at Niagara Falls. Whether the system will be based upon inventions developed in this country or upon those which have been exploited abroad it is impossible at the present writing to say. The gigantic character of the undertaking at Niagara Falls lends great interest to that enterprise. The turbines on the American side will be capable of delivering 125,000 effective horse-power by water passing through a tunnel 6,700 feet in length. It is expected that power will be furnished at this plant about the end of March, 1893. The rates announced for power are $10 per horse-power for 5,000 horse-power or over; $10.50 for 4,500 horse-power; $11 for 4,000 horse-power, and so on to $21 for 300 horse-power, all for 24-hour power if wanted, the cost of ordinary steam power for a 10-hour day ranging from $25 to $40. It is prophesied that all this power will be used up in local manufacturing establishments. Plans are also afoot to erect a plant on the Canadian side of the Falls and to utilize it in the operation of a number of railways extending for a distance of 25 to 60 miles, the towns and cities in the neighborhood being lighted by the system. The Canadian plant is intended to be operated on the polyphase plan with 25,000 volts.

One of the chief events of interest in electric lighting during the past year was the decision reached in the protracted legal controversy over the basic patent on the incandescent lamp. The suit was based upon patent No. 223,898, issued to Thomas A. Edison, in 1880. The efforts of others in the art prior to Edison's advent, notably Dr. Adams, who made experimental lamps, Crookes, who made radiometers and other devices enclosed in high vacua; Star, Roberts, Woodward, Farmer and others, it was contended rendered the Edison patent invalid, but this contention was met by those arguing in favor of the Edison patent, who successfully urged that prior to the construction of the Edison lamp no filament of carbon properly so considered had been used in an all glass globe from which the air had been thoroughly exhausted, and it was urged that Edison's efforts had resulted in success, whereas all the prior efforts to produce an incandescent lamp had led to failure. The court, in making its decision, sustained the views of those advocating the validity of the patent, and gave the patent a broad construction, covering substantially a carbon filament in an all glass vacuous globe provided with conductors leading through the glass. Although the patent has but a few years to run in this country, in view of foreign patents which were taken out, it will probably lead to strenuous efforts to develop other types of incandescent lamps. One has already been brought forward by the Westinghouse Company, comprising a jointed structure in which a glass stopper carrying the filament is accurately fitted to the stem of the bulb, the joint being sealed with some sort of paste. It is claimed that this lamp will yield good service and is cheaper to construct than the kind generally used, and is much cheaper in use by reason of the fact that when its filament wears out it can readily be repaired by reason of the ability to take out the stopper.



Improvements in Dynamo Machines.

Several interesting improvements in lightning arresters have been made, one especially worthy of note, by reason of a newly discovered property involved in its operation, is that invented by Mr. Alexander Wurts. Mr. Wurts discovered that zinc, antimony, bismuth and their compounds, have a peculiar property of blowing out an arc, or rather preventing the formation of an arc. If two cylinders of any of these metals are placed about a sixty-fourth of an inch apart, the passage of the lightning discharge is permitted, but no arc will form. If they are put further apart the phenomenon of preventing the arc does not take place. The apparatus is intended to be of service in protecting dynamos against damaging effects of lightning, being used in combination with an ordinary lightning arrester, and preventing an arc from forming across the two plates of the latter and causing a ground for the dynamo.

The development in most branches of the art has been rather of a commercial than of an inventive character during the past year. A large number of patents have, of course, been taken out, but they relate mostly to improvements upon systems or devices which had their birth at an earlier period. One ingenious application recently made with electricity is in the treatment of iron and steel castings. An arc is used in a freshly poured casting to retard solidification, giving the metal a chance to chill slowly and to become dense and homogeneous, and affording an opportunity for all gases to escape by reason of the slow cooling.

Mining apparatus has made rapid commercial strides during the past year, and several interesting inventions have been brought out for the operation of drills and coal-cutting machinery. A number of very pretty inventions have been made by Marvin, in which two differential phase alternating currents are utilized to reciprocate a drill. These currents are passed through two coils, placed one above the other, and a vibratory movement of the polar line is created by means of the fluctuation of the consequent pole, due to the changing values of the alternating current. A device similar to an electric drill in its general operation is a sculptor's tool used for chipping marble or other stones. This also has a reciprocating core or plunger, magnetically actuated to and fro, and controlled by a suitable switch.

Electric railroads have continued their rapid advance during the year. The trolley system still leads, for the reason that it is the cheapest to construct and the most successful in its operation. The senseless objection against the alleged inartistic effect of trolley wires is fading away. Conduit systems have not made any commercial headway, and the storage battery has been confined to a limited number of plants, where, however, it is said to give good satisfaction. The development of the storage battery in this country has been handicapped by the vigorous litigation in reference to the controlling patents, and now that that question has been settled by a decision of the highest court, awarding priority to Brush and sustaining his broad patents, doubtless storage batteries will cover a wider field of usefulness. In England they are largely applied as auxiliaries to dynamo machines in central station work, and there is no reason why they should not find a similar field of usefulness in this country. By October 1 of this year there were in operation or under contract 469 electric roads, equipped with 7,769 motor cars and 3,790 trolley cars, and involving over 5,446 miles of track and carrying annually over a billion of passengers. It is evident that the electric railroad has come to stay. The roads already under contract involve a capital stock of about $206,000,000. Large cities are rapidly falling into line, St. Louis, Baltimore, Minneapolis, St. Paul, Buffalo, Rochester, Boston and Brooklyn being already equipped, with New York and Philadelphia looming up close in the foreground. We have now several types of motors for operating electric cars. The old double reduction style is largely giving way to the single reduction, involving simply two gear wheels and to a newer type called the "gearless" motor, in which the armature is mounted upon a sleeve loosely surrounding the axle and operating directly upon the axle or the wheel. The gearless motors are generally of a multi-polar type so as to develop a high counter electromotive force at low speed.

Underground railways are meeting with favor. London, as is well known, has one in practical and successful operation. Another is contemplated, and has been authorized by Parliament, which will cost $6,000,000, be three miles long and have two tunnels 60 feet below the surface. One has been in progress in Paris, estimated to cost about fifty-four millions of francs. It will be 6.1 miles in length, the whole system being underground, except a short stretch at the Bassin de l'Arsenal. The tunnel is to be 1.5 metres below the level of the street on an average. The power station will be centrally located and have a capacity of 4,000 horse-power, water power from a canal furnishing a part of this capacity.

Berlin is also on the cards for an underground railway, having two lines intersecting at right angles, covering the city, and tied together by two circular belt lines, all underground. It will be constructed on the Greathead system of oval tubes 11½ feet by 10 feet, 25 feet below the surface. The trains will run at three-minute intervals. The cost of the road will be about $3,000,000.

New York city, as is commonly known, is also likely to have an underground road. The conditions of the franchise have already been published. The road must be operated by electricity or some other power not requiring combustion in the tunnel, and must be completed between City Hall and the Harlem River within four years.

The electrical exhibition held at the Crystal Palace, London, was a decided success.

Great preparations have been making for a fine display of electrical industries at the World's Fair to be held in Chicago.

Electric elevators, for use in residences, are coming into use and meeting with a favorable reception.

The price of aluminum gradually declines as electricity is brought to aid in its reduction. A basic patent in this art was issued to Charles S. Bradley during the year, covering the fusion of aluminium ore and its electrolytic decomposition by means of an electric current.

Electricity is meeting with a liberal application in tanning. A tannery in France has an output of 1,002,000 pounds of leather; two in Portugal yield 1,400,000 pounds of leather; one in Brazil has a capacity of 140,000,000 pounds. It is claimed that as good a grade of leather can be made in four days by the electric process as required 10 and 12 months by the old process, and yet the machinery outfit for a million and a half pounds of leather per annum does not exceed $8,000.

Telephony, telegraphy, and, indeed, all the electric arts, have increased the limits of their activity during the year. A great boom was given long distance telephony by the successful operation of the line between New York and Chicago, a length of 1,000 miles. This line is now in operation and conversations can be had at the rate of $9.00 per five minutes.

Improvements in Dynamo Machines.

The Elwell Parker machines which have been supplied by the Electric Construction Corporation for the South Staffordshire Tramways, and the lighting of Manchester, are of the most improved type, says the London *Electrical Review*. One of the most notable improvements, shown in our illustration, is one which permits the armature to be of easy access. It has been always found in practice that there was much difficulty in threading armatures, especially large ones, through the magnets. To obtain a proper examination necessitated, in fact, the removal of the armature or the bearings; this was always a more or less troublesome duty, because extreme care was necessary to secure a proper readjustment, and there was considerable risk of the parts getting dirty. It will be seen from our illustration how this difficulty has been obviated in a simple manner by Mr. Parker, of the Electric Construction Corporation.

ELECTRIC LIGHT FLASHES.

Clyde, O., wants an electric light installation for street illumination.

The Central Railroad yard at Mauch Chunk is to be lighted by electricity.

Thomson-Houston agents are endeavoring to introduce electric lights at Waupun, Wis.

The question of lighting the town of Franklinville, N. Y., will be voted upon this week by the citizens of that town.

Selectmen of the town of Milford, Mass., are arranging plans to be compared with bids to be offered for lighting the town.

The civil authorities, of Santiago, Chili, are inviting tenders until the first of March next for the electric lighting of the town.

Muskegon, Mich., has just made a contract for lighting the city for the next five years. Each light will cost $93.50 per year.

The Contrexville Manufacturing Company are about to install a new electric light plant to illuminate part of their mill and dwelling houses.

The Westinghouse Electric Company have received the contract to wire the Belmont Stables in Newport. There will be 950 lights put in.

The council of the city of New Castle, Ind., have decided to illuminate the streets by electricity, and have determined to purchase a plant for that purpose.

The Warder, Bushnell & Glessner Company, of Springfield, O., have in a portion of their immense factory a plant which supplies 1,000 incandescent lamps.

The Westinghouse Electric Company have completed wiring a large portion of the streets of York, Pa., and the work is being pushed to completion over the entire city.

The Water, Light and Power Company, of St. Paul, Minn., will erect a new central power station sufficiently well equipped to supply light and power to a city of 200,000 inhabitants.

The suit of the Edison Electric Light Company against the Mather Electric Light Company is on trial before Judge Townsend in the United States District Court, at New Haven, Conn.

Telescopic steel masts or rods are to be used in lighting the public squares in Brussels, Belgium. The object of this system is to preserve the beauties of the parks in the daytime.

An electric lighting plant, with General Electric Company's apparatus and New York Safety Steam Power Company's steam plant—80 horse-power engine, etc., is being installed at Highland, Ill.

The Burlington Electric Light Company, which was organized in Burlington, Ia., in May, 1892, with a capital of $200,000, has installed a plant in that city which started successfully on December 4.

The Martinsburg, Md., council has granted the right to use its streets for lighting purposes to the Martinsburg Electric Light and Power Company. This company is composed of Pittsburgh capitalists.

The Mather Electric Company, of Manchester, has received the contract for all of the electrical work in the new building of the New York *Herald*, securing the work in competition with 17 other concerns.

The electric light company of Milford, Mass., is duplicating, as rapidly as possible, its plant so that its public service may not be interrupted. A new 150 horse-power Ball engine and a 1,000 light dynamo will be started, probably, next week.

A majority of the stock of the Niagara Falls Gas Light Company was secured on December 19 by a Rochester syndicate, represented by H. C. Brewster. The new company will put in a large electric light plant and enlarge the present gas plant.

The Water Power Electric Light Company, of Des Moines, Iowa, has received its new machinery to take the place of that destroyed by fire, and the work of rebuilding and reconstruction has been pushed so rapidly that light will be furnished this week.

The number of electric lamps now used in Paris is said to be about 175,000, maintained by central stations. Out of the 85,000 houses in Paris, only 20,000, or not one-quarter, are lighted by gas, the consumption of which, in 1891, was 283,000,000 cubic metres.

The city council of Roanoke, Va. has awarded a contract to W. H. McKay for the lighting of the city with 100 arc lamps of 2,000 candle-power each for 19 cents a light

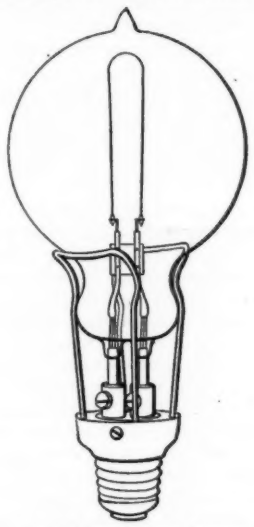


FIG. 1.—THE EDISON-SWAN SERIES LAMP.

per night. The city reserves the right to purchase the plant at its option at any time within five years.

For several months past the Edison Electric Light Company has been busily engaged in preparing its new power station in the Richmond mill, in Newport, for use in erecting three new boilers and new machinery, and transferring thereto machinery from the old station on Tew's court.

The town of Wellesley, Mass., has just been supplied with electricity. The system is made up wholly of 25 candle-power lamps, placed at the uniform distance of 125 feet in the villages and 250 feet in the outskirts. There are about 400 lights in all. The town owns its street plant and purchases its current.

The Merchants' Lighting Company, of Santa Rosa, Cal., will shortly be ready to start up their new incandescent lighting system. It is thought that the business will prove so advantageous to the residents and so profitable to the company, that increased capital will enable them to build an electric railway through the city.

It is expected that the city of Spokane, Wash., will soon own its electric light plant, to be operated by water-power. The dam near the city will develop about 4,500 horse-power, whereas not over 1,500 horse-power will be required by the water system in several years. The remainder, 3,000 horse-power, may and probably will be used for the maintenance of the electric light system.

At the last meeting of the Electric Club, of Cleveland, O., President Charles W. Wason read a paper on "House Lighting from a Street Railroad Electric Plant." In the paper the writer declares that many obstacles are to be overcome before house lighting can be profitably done from a street railroad plant. At the next meeting of the Club, Mr. J. P. McKinstry will read a paper on Underground Cabling.

The Columbia Calendar.

The Pope Manufacturing Company has sent us one of its memorandum pad calendars for 1893. This is the eighth annual issue of this valuable office accessory. If we did not already own a Columbia bicycle, we believe we could save enough money in one year by the use of this calendar to purchase the best Columbia bicycle made.

New Edison-Swan Series Lamps.

In order to meet the increasing demand for series lamps the Edison and Swan Company have introduced in England a new form of lamp and holder, the stock sizes being 16 candle-power, 32 candle-power and 50 candle-power; the filaments are made in two sizes, for 6.8 and for 10 amperes. We are indebted to the London *Electrician* for the accompanying illustrations and description.

The lamp is of the ordinary three and one-half watts type, with very strong filaments. The terminals are constructed with thick copper lugs which conduce greatly to strength and durability. An adapter is used in connection with this in order to avoid capping with plaster, which is so objectionable for large current lamps, and it affords thorough ventilation to the terminals. These are made in the Edison screw form with strong brass jaws to take the lugs of the lamp. The neck is gripped by two wire springs in such a manner that it is impossible for the lamp to fall out of the adapter, but at the same time both of these can be removed from the holder in the same way as an ordinary Edison screw lamp.

The holder consists, for the main part, of two solid brass castings fitted on to a thick fibre base; one of these, which extends across the full width of the base, constitutes the framework of the holder and also one terminal, say the positive. From this positive terminal piece are carried up two pillars which support a thick brass ring, which in turn carries an Edison screw socket, and into this the lamp adapter is screwed. Between one of these pillars and the ring is fixed a flat spiral spring of phosphor bronze, one end of which presses against the under side of the projecting arm of the negative terminal, forming the center contact of the holder, in such a manner that it short-circuits the holder so long as it is maintained in this position. The center of this arm is hollow, and in it runs a pin rather longer than the contact piece, being brass at the upper end and fibre at the lower. The only excuse for using this form of insulation is that the lampholder becomes hot, and free ventilation being afforded, the fibre will probably be kept dry; the insulation, so long as this condition is maintained, will be very fair. When the lamp is in the

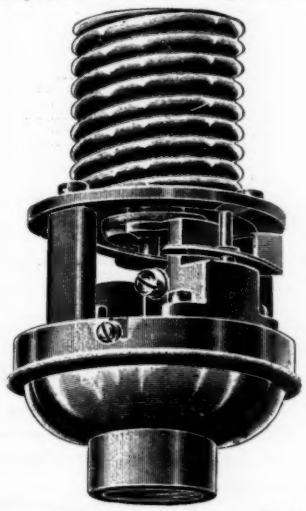


FIG. 2.—HOLDER FOR SERIES LAMP.—FULL SIZE.

holder it will be seen that the pin is pressed down so that the phosphor spring is kept at a distance, and the current passes through the lamp instead of being short-circuited across. The other end of this spring will be seen to carry a short pin, which it causes to be pressed downwards on to the near side of the negative terminal, and between these is placed the fuse paper which, the moment the lamp ceases to act from any cause whatever, receives the full volts of the circuit, and is instantly pierced so that the current continues to flow without interruption.

In factories where arc lighting is used, these lamps would be useful for offices, and where street-lighting is carried out with a set of mains distinct from those of the general supply, these glow lamps might with advantage be employed.

Primary Batteries.

LETTER FROM A GENTLEMAN OF BEAUTIFUL FAITH IN THEIR FUTURE.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your issue of November 26 we notice, in a quotation from a French electrical journal, a description of a new material for porous cups, such as are used in primary batteries. While nothing is said about their cost, it is claimed that they have a much lower internal resistance than those now largely employed; which, if true, is important.

In reference to *all* porous cell batteries a person high in authority in one of the most extensive electrical companies in the United States has recently said: "From such a cell with porous cups only a very small delivery of current can be obtained, and it is entirely worthless for work on circuits of low resistance, such as motors, as the greater portion of its energy is wasted in overcoming the resistance of the diaphragm." Before showing the incorrectness of this statement about porous cell batteries, we desire to copy from an English electrical journal the following extract from an editorial review of Prof. Carhart's book upon "Primary Batteries." It is as follows:

"Many people we believe share our feelings that there is something *innately immoral* about 'primary batteries.'"

According to the first authority quoted, porous cell batteries are useless for work upon circuits of low resistance and by the latter all are denounced by a journal of high pretensions as "innately immoral."

Dismissing the extract from the English journal as a sample of that kind of exalted scientific idiocy that we are sometimes called upon to endure among other earthly afflictions, we will attempt to show from real trials that porous cell batteries are not now chargeable with the defects attributed to them by the authority first quoted.

We affirm that porous cells for batteries for work upon circuits of low or high resistance have been perfected so that they do not increase the internal resistance of the cell to any injurious degree, while they keep the inner and outer solutions (the excitant and depolarizer) separated while the battery is at rest, so as to prevent injurious or wasteful action upon the zinc.

We have now before us a battery of four cells, size of porous cup, 7x7x3. They were charged to operate a motor three weeks ago this day. After working several hours continuously, they have been permitted to stand as first charged, only working a few minutes each day. The liquids retain their distinct colors and there is no attack upon the zincs when at rest. We have a single cell of same dimensions charged 12 days ago, running six hours per day (except Sunday), with no removing of the zincs or carbons from the cells, and with no appreciable waste while at rest. Liquids remain distinct as before stated. A cell of the dimensions named will show 25 amperes on short circuit and will not polarize, but will remain constant until the "generating part" weakens, which time will depend primarily upon the charge in the outer jar and its dimensions. The longest time I have had a cell upon short circuit was five hours, showing 30 amperes, size of cell was, porous cup, 9x9x2, outer jar (rubber) 3¾x10x10 inches. In the outer jar was acidulated water, one part acid to 25 water. The depolarizer is the weakest I know of being used in similar batteries.

This cell will do almost any work that can be done by storage cells, and is well adapted to propelling electric launches, as no previous mixing of solutions is necessary, it being furnished in form of salts and put up in separate charges for each cell.

It will be asked by many of your readers how such a porous cell is secured and if they are for sale.

I will say that they are not used as they come from the battery, but by a process patented the cups are rendered durable and the right degree of porosity obtained, and they work with perfect uniformity. So, Mr. Editor, there is hope for the primary battery yet to become useful, and that in a large field where it must be used or the field remains without the assistance of electric power entirely. I have already taken too much of your valuable space, and will defer description of a recent trial of cells upon lamps, in the presence and under supervision of one of the best informed and practical electricians of this city, until some future time. Very respectfully yours, W.

New York, Dec. 9.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
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STEPHEN L. COLES.
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REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

EUROPEAN OFFICE:
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HOTEL VICTORIA,
Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.
Telegraphic Address: Ffrench, "Victoriola," London.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

SUBSCRIPTION TO THE ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

NEW YORK, DEC. 31, 1892.

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THE OPINION OF AN AUTHORITY:

"The editorials appearing in ELECTRICAL REVIEW have been of untold value to all electrical enterprises."

A. M. YOUNG.

An electric sleigh, which will leave both of the man's arms free, has been invented. What a vision does this bring to the mind of the ardent young lover, and how he will be grateful for this innovation, as he uses both of his arms to good purpose on a cold moonlight night, while the crisp and nipping air whistles gleefully over the dashboard.

What the public wants is well constructed electric systems of all kinds. The companies that do not furnish these will not be in the race. Descriptions and highly colored tales will not do. An author once visited a poor starving woman. "Read," said he, "my realistic description of a Christmas goose." The woman read and was hungrier than ever.

Mr. Durborow, of Illinois, introduced in the House of Representatives, last week, a joint resolution to leave the matter of Sunday observance at the World's Fair within the power of the regularly constituted authorities of the Exposition. This Sunday business is not so important to the electrical interests as the fact that the Fair must be kept open in the evening, in order to properly display the electrical exhibits.

So we may expect rapid mail delivery to almost any part of Brooklyn. If this plan is successfully carried out, and we see no reason why it should not be, we can have a letter delivered by post in a shorter space of time than it would take for a messenger boy to go across the river at his most rapid rate. A trolley line in a rectangular tube, with light and strong motor carriages, is the line equipment. Branches may be run in any direction and mail transportation is thus greatly facilitated. But they were obliged to employ electricity to do it.

President Howell, of the bridge trustees, says: "We are experimenting with electricity both for lighting the trains and for switching purposes, and the very best electrical experts in the country are studying the problem. We hope soon to have it in operation, and, more than that, I think that within two years the bridge cars will be run by electricity." The lighting of the bridge cars is, at the present time, not what it should be, and the installation of electric lights, and the single or double trolley system, will be an improvement which will gladden the hearts of the thousands of people who daily patronize the existing cable cars.

It is encouraging to learn that a determined effort will be made at Albany this winter to have the legislature repeal that section of the penal code relating to the infliction of the death penalty, and have adopted in its stead a life imprisonment section as the severest penalty to be inflicted for murder in the first degree. It is rumored that Governor Flower is in favor of such a measure, and that it has many strong supporters among the Representatives returned to the present House. The proposed bill transfers the pardoning power from the chief executive to the court upon the production of new and extenuating evidence. It is sincerely to be hoped that the measure will pass at as early a date as practicable, so that the prostitution of the electric current in New York State may cease forever. It would also be well, if it were possible, to make the measure retroactive in order that the eleven murderers now confined in the prisons of the State might be imprisoned for life instead of being tortured to death by electricity.

When a father does not wish his son to follow his profession or business and desires that he choose one for himself, the young man, like the amateur painter who selects the most difficult subjects to begin with, immediately conceives the idea that he would like to be an electrician. The father, of course, notices how his boy has had a penchant for electricity, and how, when he came home from school after hearing his first lecture on batteries and bells, he began to buy up old copper boilers and zinc stove mats, and to secrete all the old teacups to make batteries. He notices the gradual evolution through all the stages of the affection and the culminating point is reached when his boy declares that he wants to follow electricity as a profession. As a rule, the father immediately takes the boy to some expert electrician and receives advice free. Time rolls on; the young man, now in the chrysalis stage, goes to some university, and later he dries the wings of his college acquired knowledge by contact with the world and they aid him in soaring to the heights of fame. The newspapers chronicle another rising electrician; and this is the way in which the inventors and great men of the future are made.

DR. CORNELIUS HERZ.

On the first page of this issue of the ELECTRICAL REVIEW will be found a copyrighted portrait of Dr. Cornelius Herz, the one man who is said to hold the reins of government and destiny of France in his hand at the present moment. This is the best portrait that was ever made of Dr. Herz, and the copy from which our engraving was reproduced is positively the only one in this country, outside of Dr. Herz's immediate family. In thus presenting to our readers a picture and biographical sketch of a man who is at present the focal point of the public interest of two continents, the ELECTRICAL REVIEW achieves a journalistic feat which no other paper has yet accomplished. His political actions are of great present interest and of a peculiar character. Some interesting stories are told of him which may be added to later.

Dr. Herz's personality is especially interesting to the American electrical world, as he has worked among, and knows intimately, many of the older electricians of this country. Those Americans who visited the Paris Electrical Exposition of 1880, which was originated by Dr. Herz, and those who have visited Paris since, can tell of the courteous reception they received at his hands and from his paper, *La Lumiere Electrique*, if they were fortunate enough to make themselves known.

Dr. Herz is a gentleman of great wealth, and his influence has already been felt in France, both on account of his own forceful personality, and because of his intimate relations with General Boulanger during the ascendancy of the latter's star of triumph. Dr. Herz is at present in England, from which point he is said to be directing movements which will have the most important influence upon the future of France. It is rumored that he is coming to the United States, of which he is a naturalized citizen.

THE SEASON'S GREETINGS.

This issue of the ELECTRICAL REVIEW is prepared and sent out to the world in the midst of holiday bustle and happiness. The busy electrical worker hasn't much time to devote to thoughts of Christmas and his principal interest in the ending of one year and the beginning of another is whether he has accomplished all that he should have done in 12 short months. Whether he has or not will not prevent him, probably, from writing "92" in place of "93" for several days to come.

But in this *fin de siecle* life of ours it is not "a-fittin' nor a-proper" for us to entirely supplant sentiment with practicality, as many of us are prone to do. It will not hurt any who are strangers in a strange land to let their thoughts wander backward at this season to the many Merry Christmases and Happy New Years they have spent "at home" and from which they are now separated by force of circumstances. Let us go back in our memories, as Ik Marvel does in his "Reveries of a Bachelor," and live over again the good old times. An imaginative Christmas is a poor substitute for the real article, but it takes off a little of the sting of "Christmas in a boarding-house."

Those who are fortunate enough to celebrate the holidays in their own homes are indeed lucky and should not let the remotest thought of business intrude to mar the festal occasion.

To every reader and his family, the ELECTRICAL REVIEW extends with all heartiness and cordiality the season's greetings and sincere wishes for a profitable, prosperous and Happy New Year.

There is no better field in the country for electric railway work than in the New England States. The thriving cities and towns in this section lie close together, and the people are rapidly waking up to the advantages to be obtained by the easy and rapid communication afforded by electric traction. The next few years will undoubtedly show a wonderful development in this field, and the manufacturers of railway apparatus will reap a harvest.

CORRESPONDENCE.

OUR BOSTON LETTER.

The **Electric Gas Lighting Company** have several little novelties in hand which will be given to the trade about the first of the year.

Mr. **Harry Bishop,** formerly with the *Street Railway Gazette*, has been appointed General Western Agent for the Massachusetts Chemical Company, of this city. Mr. Bishop's appointment dates from January 1, and his headquarters will be in Chicago.

The **New England Telephone Company** are in the market for 25,000 cedar and chestnut poles, to be used in repairing and extending their system in this section. The poles will run from 30 to 65 feet in height, and will measure from 9 to 16 inches at the butt and about seven inches at the top.

The **Boston Electric Light Company** have begun work on the foundations of their new station at East Boston, and the work will be pushed along as rapidly as possible. The station will have a capacity of 2,000 horse-power and the Thomson-Houston and Brush systems will be used for incandescent and arc lighting.

The **Beacon Vacuum Pump and Electrical Company** are meeting with great success with their incandescent lamps, and while the low figure at which they are putting them on the market has largely increased their orders, they are enabled, through their increased facilities and improved methods, to meet all demands promptly.

The **Residents of Brookline** are exceedingly anxious for an improved electric street car service between their suburb and Boston, and had a hearing on the subject before the selectmen last week. The West End people expressed their willingness to do all that was possible for the improvement of the service at once, and expected to have an extension of their line in operation next spring.

The **American Circular Loom Company** are consolidating their business by removing their plant from West Hanover to Chelsea, the factory at the latter place having been enlarged, and arrangements made to handle the entire business from that point. Mr. H. H. Brooks, the general manager, has recently returned from an extended trip through the West and on the Pacific slope, and reports business in that section in a most flourishing condition.

The **West End** car stables, at Everett, were the scene of a disastrous fire on Wednesday evening of last week, by which the immense car house, a structure 400 feet long, 85 feet wide and 33 feet in height, was totally destroyed, as well as 20 open summer cars and 19 new closed cars, which were stored there at the time. The total loss will amount to about $125,000, and five men, employés of the company, lost their lives in their efforts to save some of the property.

The **Campbell Electrical Supply Company,** of which Mr. Henry F. Campbell is president, and Mr. Ronald A. Stuart secretary and treasurer, have opened up for business at 104 High street, this city, and are now prepared to handle a full line of their "Century" insulated wires, insulating tapes and insulating paint. Mr. George F. Talcott is at the head of the sales department, and has just gotten out a neat little catalogue giving full particulars of their several specialties, and some valuable tables on dimensions, resistances and equivalents of wires.

The **Locks and Canal Company,** of Lowell, Mass., are considering plans for utilizing power from the Merrimac River for generating electricity, and distributing it to the large textile corporations which compose the most important element in the industrial field of this busy little city. The Locks and Canal Company, while an independent concern, is virtually controlled by the large corporations of the city, the treasurers of the latter composing its board of directors. The plan contemplated is to tap what is known as the northern canal, which is an auxiliary feeder to the smaller canals which convey the water to the various mills, and to establish a power station at this point.

Boston, Dec. 24. H. G. T.

OUR CANADIAN LETTER.

Windsor, Ont.—The People's Electric Light Company have purchased a site on Robinson street, on which they will at once erect a power house.

Niagara Falls, Ont.—Messrs. Wm. Kennedy & Sons, of Owen Sound, Ont., have been awarded the contract for the turbine wheels to run the dynamos for the electric railway now under construction.

Smith's Falls, Ont.—The Smith's Falls Electric Power Company, which has recently been incorporated, will next spring erect a new flume and buildings, to be fitted with the most improved machinery.

Montreal, December 24. J. A. C.

An Unfair Use of a Fare Register.

To the Editor of Electrical Review:

One of the most ingenious means for aiding the street car conductor in appropriating a few fares to his personal use is at present in operation on an electric road not far from New York city.

In the office of the company there hangs a sign on which is printed words to the following effect: "Postmen who carry bags shall be permitted to ride free, but the conductor must ring up one fare for each postman, so that the company shall know the number of postmen that have ridden on the cars during the day."

When we come to analyze this order, and look into this remarkable privilege, we are inclined to make a guess at its probable meaning.

I have inquired into the terms of the agreement with the post office department, but could learn only that the government pays for the privilege of allowing its postmen to ride free on the lines of that company.

On the surface, there is nothing extraordinary in this contract, but how does it affect the conductor, who is but a traveling assistant cashier of the company?

Suppose that five postmen have ridden on a car during the day, and that when the conductor turns in his register and record book that there are, say, ten or even fifteen fares unaccounted for. It must naturally follow that either the conductor has appropriated them to himself, or that the unaccounted fares are the record of the number of postmen in active service who have ridden on the car that day.

If the contract with the government is such that the amount paid to the company is so much for each postman that has ridden on its cars, we see immediately that by this method, the more fares that the conductors appropriate, the more will the government have to pay for the privilege.

The possibilities of this system remind me of an incident that happened in the days before the elevated railroads were built, when the street cars had a monopoly of the traffic. A new conductor had been put on a car and was told to ring the bell once for each person that got on the car and paid his fare. At the end of his trip from 65th street to the post office and back it was found by the official of the company whose duty it was to inspect the registers that No.— had not rung up a single fare for the entire trip. No.— was politely requested to walk up-stairs with the inspector to the office of the superintendent, who, when he had been appraised of the facts, asked the conductor how it was that he had failed to register the number of fares collected by him?

"Shure, there wasn't nobody got on," was the cool reply.

When the superintendent had recovered from the shock, he said: "My dear sir, allow me to tell you good-bye, but before you leave us, let me offer you the sincere thanks of the president and stockholders of the road." With a suspicious moisture—humor—in his eyes he continued—"I am sorry that I am unable to express in fitting terms our heartfelt gratitude; but believe me, sir, words are not yet made that are capable of informing you of our pleasure at recognizing the delicate consideration you have shown in bringing back the car." Argus.

New York, Dec. 24.

A Valuable Franchise.

At a meeting of the Brooklyn Board of Aldermen, recently, a communication was received from President Lewis, of the City Railroad Company, applying for a franchise to construct and operate, either by horses or by the trolley or cable, a road in connection with the present system of the company upon almost all of the streets tributary to the existing routes. From 50 to 60 streets are included in the proposed additions to the present lines of the city railroad. A supplement to the application, which surprised some members of the board, offered to pay the city $250,000 upon the perfection of the franchise, and agreed to deposit a certified check for the amount at such time as the Mayor and Comptroller should direct.

The application was referred to the Committee on Railroads. There is another application, presented a week ago, still before the same committee. It was presented by the Kings County Electric Railroad Company, which was recently organized by some leading politicians and contractors, and the privileges it asks for are substantially the same as those included in the application of the City Railroad Company. The Kings County Company has not, however, offered a dollar for the franchise.

Continuous to Alternating Current Transformer.

A most interesting invention of Sir David Salomons and Mr. L. Pyke has for its design and object to change a continuous current of 100 volts and 10 amperes into an alternating current having an electromotive force of 100 volts and one ampere, and an alternation rapidity of 1,000,000 per minute. This is ingeniously effected by means of a motor-driven alternator, says the London *Electrical Review*. Hitherto nothing has been accomplished within a tithe of 1,000,000 alternations. The diameter of the machine does not exceed one foot for the rotating portion, and as more than 10 poles to the inch could not well be obtained, the requisite alternation frequency is arrived at without an excessive speed by a simple and highly effective plan, viz., by rotating the field and armature of the motor in opposite directions, the brushes of the commutator proper being carried by the field.

The reactionary effect on the field is necessarily as great as the tendency of the alternator to turn, their speeds being equal, thus 3,000 revolutions is equally divided between the two bearings.

The primary current is taken to and the alternating current is brought away from the rotation portion by carefully insulated wires passing through the spindles, which are hollow, being connected to their respective terminals by the device of rings and springs.

As the whole of the weight is overhung, it is absolutely necessary that the bearings are true, and as the diameter of the polar faces is very small, necessitating very small air space, white metal thrust bearings are employed.

This apparatus will be of great value for the quantitative investigation of phenomena, as yet but crudely explained by means of inappreciable currents.

Sir David Salomons recently exhibited the alternator at the Institution of Electrical Engineers, together with a transformer for raising the potential of the alternating current to 100,000 volts.

ITEMS OF INTEREST.

The telegraph companies of the United States employ 37,000 women operators.

The recent storms have wrought havoc to all kinds of wire in Peoria, Ill. The work of repairing the telephone lines is still going on, but as yet 50 telephones are silent.

Superintendent O'Brien, of the Western Union Telegraph Company, has just introduced Edison's system of quadruplex telegraphy between Scranton and New York city.

The directors of the North American Telegraph Company recently held their annual election. Officers were elected as follows: C. M. Loring, president; A. H. Wilder, vice-president; H. F. Brown, treasurer; H. A. Tuttle, general superintendent; W. H. Eustis, secretary.

The affairs of the Electricity Building at the World's Fair are progressing rapidly, and everything will soon be in readiness to receive the machinery for the grand display which will be furnished by this department. A large force of painters and plumbers are busily engaged in decoration and fitting up the interior of the building, which now presents a fine appearance. The offices of this department are now located in the gallery at the extreme south end of the building, and are rapidly being put in shape to handle the vast amount of business which will fall upon Secretary Hornsby and his forces.

LETTERS FROM A LABORATORY.—XXVII.

By Julian A. Moses.

The care of the hands in and out of the laboratory is a subject that has vexed many workers, and it is not always the man who is not neat that is obliged to have unsightly hands. Their condition is in a measure dependent on the kind of work done at the time. Certain chemical processes leave them spotted and stained, and naturally the experimenter feels a certain diffidence about being seen in company without some covering for them. These stains may be prevented and removed in many cases and the hands left in their natural condition.

Those stains which are the result of the contact of acids with the skin are the most difficult of removal, and often they must remain until nature has restored the damaged cuticle. But certain chemical reagents can generally act as preventives or cures.

Nitric acid stains the skin a deep yellow. To prevent all acid stains, it is advisable while working with them to keep the hands continually wet with water, so that if any of the corrosive material does chance to fall on them, it will be immediately diluted and the action will not be as strong as it would be were the acid concentrated. If the stains are already there, continued rubbing with a mixture of fine white river sand and salt or sugar, slightly moistened with some strong alkali, such as ammonia or caustic soda, will help a speedy renewal of the dead skin.

Black stains, resulting from nitrate of silver, may be removed by continued friction or by dipping the stain in cyanide of potassium. The former method is preferable, as the cyanide is highly poisonous, and its use is, for that reason, not recommended. I know of cases where sickness and death have resulted from the application of this deadly poison. In one case, a girl employed in a silver-plating factory would dip her hands, when soiled, into the cyanide bath. This habit was continued until one day, after dipping her hands as usual, she pricked herself with a pin. No immediate notice was taken of the smarting, and in less than a week the poison had taken effect and caused her death. Moral, do not use the cyanide of potassium any more than you can possibly help.

It has been advised, to remove varnish from the hands, to soak them in alcohol; but this is a slow process. A more expedient method is to pour caustic soda or potash over the varnish and rub the hands briskly together, at first using no water. Nearly all varnishes are soluble in the alkalies, and can be thus easily removed.

Where tenacious oils adhere to the hands, ether or any caustic alkali can remove them; with the former, a solution is made which should be rubbed off with a dry cloth; and with the latter, a chemical combination is the result and soap is formed which is readily soluble in water.

Ink stains may be removed by wetting them with oxalic acid or hypochlorite of soda. It would be wise to have a bottle of this latter chemical always at hand, for it is one of the most effective materials for cleansing. This substance commonly called "Eau Javelle," liberates a certain amount of chlorine, which gas and its solution in water will dissolve or render soluble many of the substances liable to stain the hands.

Oxalic acid has the peculiar property of turning the part of the finger nails above the quick to a white or milky color, and is often sold under fancy names, in ornamental bottles, and for fancy prices, as a preparation for removing stains and beautifying the finger nails, etc. Nevertheless, it is a very useful preparation to keep at the side of the laboratory wash basin to use as a preventive for spots and stains.

Peace will reign between the Chicago Telephone Company and their linemen for at least a year, the company having signed the union's agreement. The officers report that there are now but two or three companies that have not signed.

Regulation Test of the Ryan Special Series Motor.

BY W. L. BLISS, IN THE "SIBLEY JOURNAL OF ENGINEERING."

In the October number of the *Journal* appeared an article on "A Method for Balancing Armature Reactions," by Prof. Harris J. Ryan. The subject of armature reactions has received much study and attention of late years, but as yet, with this single exception, no one seems to have devised a means by which their deleterious effects could be eliminated. This method was clearly outlined in the article referred to, and it was with the view of extending the investigation of the working of the machine in question, and to verify the predicted results, that the present test was undertaken.

The machine tested is of the bipolar type with cast iron field, drum armature and small air gap. Following are its principal dimensions: Armature built up of iron discs; diameter of armature core, 6 inches; length of armature core, 6 inches; number of grooves in armature core, 64; number of No. 12 B. & S. G. wires in each groove, 6; number of sections in armature, 64; number of turns per section, 3; number of bars in commutator, 64; number of turns on armature (total), 192; number of wires on armature, 384; length of air gap, 125 inches; number of turns on field core, 250; size of wire in field core, No. 7 B. & S. G.; reaction cable consists of eight No. 8 B. & S. G. wires; number of slots in each pole face, 6; number of turns passing through each pole face equals one-half number of turns on armature; armature potential, 100 volts; armature current, 20 amperes; armature speed, 1,600 revolutions per minute.

The motor was set up in the laboratory and connected by means of a belt to the Ryan-Thompson dynamo, which was driven as a motor and supplied with current from the Edison mains. The first step in the test was the determination of the internal characteristic. A variable resistance was included in the field circuit, together with an ammeter, the current for excitation being also supplied from the Edison mains. A voltmeter placed across the terminals of the motor served to measure the armature potential. The speed was maintained as nearly constant as possible, and readings of the voltmeter were taken each time the excitation current was varied. From this experiment the following data were secured:

TABLE I.

No.	Speed.	VOLTS. Observed.	VOLTS. At 1760 R. P. M.	Field Current, Amperes.
1	1680	26.5	26.8	1.25
2	1805	37.5	35.3	2
3	1800	48	45.3	2.95
4	1700	58	58	3.9
5	1700	65.5	65.5	5.2
6	1650	73.5	75.7	6.25
7	1640	79	81.9	7.3
8	1650	87.5	90.1	8.5
9	1760	95	91.8	9.3
10	1720	99.5	98.3	10.4
11	1680	104	105.2	11.95
12	1480	104	119	13.7
13	1850	123.5	113.5	14.9
14	1810	135	126.8	18

When these results are plotted it is seen that the characteristic curves vary gradually and do not contain the "knee" which is peculiar to most magnetization curves. This, however, is due to the fact that the field consists of cast iron and that the air gap is exceedingly small. In the following experiment the full meaning of this statement will be made manifest. A trial was now made in which the field excitation current was maintained constant. The Ryan-Thompson dynamo served as a load for the motor, and, by varying the load on the dynamo, that of the motor was changed also. Three runs were made with potentials of 102, 90 and 80 volts, in each run varying the load from about 8 to 18 amperes. The results of this trial are given in Table II.

TABLE II.

No.	Speed, R. P. R.	Volts.	F'ldC'r't Amp'res	Arm. C'r't Amperes	Watts Cons'med
1	1680	102	9.9	9.1	929
2	1720	102	9.9	10.9	1112
3	1600	102	10	13.2	1346
4	1600	102	10	15.2	1550
5	1620	100.5	10	17.6	1795
6	1480	90	9.95	8.5	765
7	1500	91	10	7.7	701
8	1480	90	10	11.6	1044
9	1530	90	10	14.	1260
10	1480	90	10	15.5	1395
11	1480	90	10	16.9	1521
12	1480	90	10	17.9	1611
13	1480	90	10	17.6	1584
14	1400	90	10	19.3	1737
15	1320	80	10	8.5	680
16	1280	79	10.5	9.8	784
17	1200	80	10.1	11.9	952

We see from this table that the speed remained practically constant, especially in the second and longest run at 90 volts potential. However, as the above conditions would never be met in practice, a final test was made in which the field current was determined by the potential at the terminals of the machine as in any shunt motor. In this case, the field coil and some extra resistance constituted a shunt across the brushes. In any one run, using a constant potential at the terminals of the motor, the field current was necessarily very nearly constant, or should be.

Runs were made using potentials of 110, 100, 90, 80, 70 and 60 volts, also varying the load from 3 to 25 amperes, approximately. Table III shows the results of this experiment.

TABLE III.

No.	Speed, R. P. M.	Field Current Amp'res.	Armature. Volts.	Armature. Amp.	Watts Consumed
1	1800	9.9	110.2	3.2	353
2	1722	10	109.7	7.1	779
3	1750	9.95	110	11.4	1254
4	1650	10.1	110.5	15.2	1680
5	1580	10.15	110.8	20.6	2282
6	1610	10.3	109.9	23.9	2627
7	1650	9.2	99.3	3.1	308
8	1660	9.1	99.4	9	895
9	1570	9.1	100.3	13.1	1314
10	1500	9.23	100	16.6	1690
11	1440	9.4	99.9	20.8	2078
12	1620	8.1	89.7	3	269
13	1550	8.45	90.3	6.8	614
14	1400	8.5	90.5	11.9	1077
15	1390	8.6	90	16.9	1521
16	1400	8.8	90.6	21.6	1957
17	1520	7.85	80.1	3.1	248
18	1460	7.5	80.3	6.4	514
19	1340	7.55	80.2	11	902
20	1376	7.55	79.9	14.9	1191
21	1240	7.55	80.2	20.2	1620
22	1380	6.45	69.6	2.8	195
23	1230	6.7	70	7.2	504
24	1240	6.9	69.4	11	763
25	1200	7.1	69.8	15.6	1089
26	1200	7	69.8	14.7	1026
27	1120	7.1	69.2	20.2	1398
28	1240	5.7	60	3.1	186
29	1200	5.8	60.5	7.6	460
30	1100	6	59.4	11.8	701
31	1100	6	60.3	16	965
32	1000	6	60.5	20.2	1222

From the above results it is seen that, for any particular run with a certain potential, the speed remained quite constant, but that when the potential was raised or lowered the speed increased or diminished. This action is due to the curving of the internal characteristic. As the potential falls, and consequently the exciting current, the magnetization does not correspondingly diminish, and hence the motor does not need to speed up to produce the requisite counter-electromotive force. This results in a dropping of speed which might be interpreted as poor regulation. It is evident that in order to produce the desired result, the internal characteristic must be made straighter, and this can be done by introducing a proper air gap into the magnetic circuit.

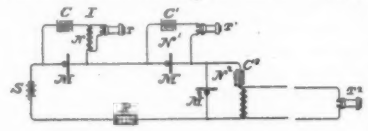
The compensating coils, so far as balancing the armature reactions and maintaining the neutral axis in the axis of commutation, performed their functions most admirably, as no sparking was observed at the brushes under the heaviest loads, and no shifting of the same was necessary.

These latter results, concerning the maintenance of the neutral axis in that of commutation of armature reactions, verify the experiments made by Dunbar and Lunt, and which were incorporated in their thesis of June, 1892.

In Northampton, Mass., the Boston and Maine road has opened a telegraph office of its own, occupying a portion of the room which has been used as a lobby by the railroad men, and hereafter the Western Union will be closed at 9 P. M. However, the Boston and Maine office will do nothing but railroad business.

Novel Telephone System.

In a patent recently issued to John S. Stone, of Boston, is described a telephone system in which it is aimed to develop a greater range of potential variation in the primary circuit of a transmitting induction coil than has heretofore been possible. One form of the invention is illustrated in the accompanying diagram, wherein is shown several telephone circuits supplied by the same source. A source of energy, represented by S, which may be a primary or storage battery, or even a continuous current dynamo electric machine, is placed in series relation with as many transmitters as may be desired, indicated by the letters M, M^1, M^2, and including a resistance R. In shunt relation to each microphone transmitter M, M^1, etc., is placed a condenser C, and the primary of the transmitting induction coil N. The fluctuations of electromotive force developed by the increase and decrease of resistance at the microphone contacts varies the strength of the charging current upon the condenser contained in the shunt circuit, which, reacting upon the primary of the induction coil, sends induced alternating currents to the line, which operate the receiving telephone T. The resistance indicated at R may be a simple non-inductive resistance or may be an electromagnet or some other self-inductive device. It will thus be seen that by reason of the complete conductive circuit from the generator through the microphone contacts a comparatively strong current can be utilized developing a wide range of variation at the condenser surfaces, which range of variation reacts upon and is increased by the transforming action of the induction coil. By employing a generator of considerable electromotive force, and bringing the normal current flowing in the conductive



STONE'S TELEPHONE SYSTEM.

circuit to the proper value by means of the resistance R, the operation of the transmitter develops a greater variation of potential between the two sides of the condenser than would be possible with a lower electromotive force in the usual type of transmitting outfit; for example, good results may be obtained by employing a generator having a electromotive force of 100 volts, a resistance of 92 ohms, and a transmitter microphone having a normal resistance of 8 ohms. A condenser under these circumstances may have a capacity of four microfarads. If an electro-magnet is substituted for the resistance R, the ohmic resistance of the generator circuit may be made much less as the self-inductive reaction of the electro-magnet opposes a certain amount of spurious resistance, which takes the place of considerable non conductive wire. One or any number of transmitters may be used in the conductive circuit of the generator S, thus simplifying the management of the transmitting outfit where a number are located at the same station.

Beginning with volume V, the first number of which has been issued, the *Technology Quarterly* will be published by the Society of Arts of the Massachusetts Institute of Technology, under the title, *Technology Quarterly and Proceedings of the Society of Arts*. The *Quarterly* thus becomes an official publication of the Institute. Its character, however, will not be greatly changed, although the publication of all the principal papers read before the Society of Arts will slightly increase the proportion of technical subjects. In order to make the price of subscription more nearly equal to the cost, and in view, also, of the fact that the membership fee of the Society of Arts is $5 per annum, the executive committee have placed the subscription price for those not members of the Society at $3 per annum, postpaid. Members of the Society will receive the *Quarterly* free of charge.

Electricity in the Art of War.

BY LIEUT. C. D. PARKHURST, U. S. A.

It is evident, then, that we can have a high rate of efficiency by keeping down the loss due to this third factor, and due attention has been given to the matter in all the applications that have been made. These applications have been simply enormous. But a few years ago there was hardly a motor (electric) in use in the United States. To-day one single company numbers them by the thousand, with an aggregate horse-power that is simply bewildering to contemplate. Motors of all powers, from one-sixteenth horse-power to 200 horse-power, with commercial efficiencies varying from 70 per cent. to 92 per cent. are guaranteed by the manufacturer. Electric car lines running up into the hundreds have been built and are building, for distances of from two miles up into the hundreds; more than 450 roads operated by electric power, with a total mileage of more than 3,600 miles, employing nearly 5,800 motor cars are reported; in one year nearly 30,000 horses were replaced by electric cars; all this would look as though the motor was an accomplished success, and that electric power has come *to stay*.

For our military problem, therefore, we have a means of transmission of power that has been tried in nearly every conceivable way, and has not been found wanting. The engine and boiler that we must have to generate power can be applied safely and economically to the generation of electricity in as large amounts as we may need or desire. This generating plant can be centrally located, protected, efficiently run by a small crew of skilled employés, and therefore compares most favorably with any of the other means of power generation heretofore considered.

With this much in its favor as a beginning, the great superiority begins to be more pronounced when we consider the means of transmission, and of reconversion into power after transmission. Instead of bulky, costly and cumbersome ropes, pipes, or shafts, we have a few copper mains, that need not be large, as compared to a five or six-inch pipe. These mains can be carried in any manner. Frost does not affect them, therefore they need not be protected from freezing, and can be anywhere, even upon poles, in many cases. If a wire should be shot away, the most ignorant man in the command could splice it temporarily, even with a current on; for with voltages up to 220 no danger would result from contact with live wires.

As stated in the wiring for the lamps in previous pages, whatever system of wiring was introduced, it should be with interlocking mains, branches and feeders. Then if any wire was shot away and could not be spliced at once, the closing of a switch would throw that branch or main upon some other circuit, from which it could receive its power until repairs could be made. The wiring, too, should be such as to allow but small loss in transmission. This is but a detail of first cost; the relative gain in efficiency by a less drop in the leads being balanced against the greater first cost, to determine the expediency of the limit to permissible loss. We now have this second advantage in its favor, and let us look to ultimate application for our final result.

Of all machines made for the application or conversion of power, the electric motor may be ranked as the best. With but one moving part, the armature, it has but one part to give trouble, the commutator, and that has long ceased to be troublesome for voltage such as we would probably use. Even up to 1,000 volts the commutator can be relied upon, and it is only when we run up into the thousands that much trouble is experienced.

For equal horse powers the electric motor occupies less than half the space of a steam engine, and weighs less. Special forms of motors are being and have been developed for special work. We tuck away a 15 or 25 horse-power motor under a street car without much trouble, and we certainly can find room between the chassis rails of our gun carriages to put our motor. The motion of the armature being rotary to begin with, needs no conversion, but is applicable directly through a proper train of gears to slow down the speed and apply the power to the best advantage. The motor can be *started slowly*, thus beginning to move its load without undue shock or strain; after starting it can move the load rapidly or slowly at will. When we wish to stop, the motor can be slowed down, and the gun stopped, just as we wish it to be stopped at its proper place, with its proper azimuth, without any necessity for "backing and filling" to get the gun properly directed. The motor that is worth the name has no dead centers; it can be made with a powerful torque so as to be able to start a heavy load, and no attention need be given to anything but the proper control of the gun, no thought being given to the motor, the position of its armature in stopping or starting.

Anyone, even the most ignorant cannoneer, can operate it by opening or closing a switch; beyond an occasional oiling, by filling self-oiling bearings, and cleaning the commutator, the motor runs itself. When the bearings become worn, and that will not be for years with anything but the most criminal carelessness and neglect in the way of oil, new bearings can be slipped in by anyone who knows how to use a monkey wrench, and the motor is as good as new.

As for reliability and freedom from any breakdown, it may be stated that the motor of to day is unique in its record. In the commercial world hundreds of motors, of all sizes and types, are in daily use for 8, 10 and 12 hours a day every day in the year, with the repair account next to nothing. Nowadays "crossed" and "burnt-out" armatures; cut and scarred commutators from sparking and improper construction; trouble with field coils, are the rare exception. To-day a mishap is extremely rare. Motors are not put under glass cases and labeled "handle with care." They are tucked away under street cars, but six inches above the street, and run the car through slush, snow, mud or rain from 16 to 18 hours out of the 24, averaging from 90 to 120 miles per day. No service that we could possibly put them to in handling our guns could compare with this, either in variation of speed or load, length of continuous duty, suddenness of shocks or strains, unfavorable conditions of weather or streets, inaccessibility and narrowness of space allowed, and lack of even a small amount of attention. These motors run, not by reason of any fostering care on the part of the motor-man, *but in spite of him.*

Our motors must necessarily be exposed, to the elements uncovered and unprotected, except when in casemates. To meet this the motor of to-day can have a stream of water played upon it from a hose, to wash it off and clean it, without injury. Armatures have been tested for insulation and found all right, have been soaked for 24 hours in hydrant water, taken out and tested again and found to be sound in every respect. An armature was then put in salt water for 24 hours, taken out and put at once into a motor, without drying of any kind, and the motor ran for two hours at an overload of from 25 per cent. to 50 per cent. without trouble or breakdown. No more conclusive test could have been devised.

Field coils and armatures can be made *absolutely* waterproof, hence no fear need be felt that there will be a breakdown from exposure to the weather.

Though from its position pretty well secured against injury from hostile shot, the motor may be encased, if need be, so as to be proof against pretty heavy fire, so that stray bullets from Gatling or rapid fire guns need not affect it. It can be much better protected than any other form of motor from its compact form, and there being but the one moving part. When fire gets heavy enough to disable the motor, the position of the gun would be untenable anyway, and the gun itself, or its carriage, probably be disabled.

We then have an efficient, thoroughly reliable and easily applied mechanism to convert our power into mechanical energy at the gun, and the advantage of this system may now be summed up:

1. Efficient and reliable means of power generation.
2. Efficient and reliable means of transmission.
3. Efficient and reliable means of conversion and application.
4. Efficient and reliable means of gun control.

What more anyone can ask for is hard to see.

It may be objected that this is all very well for short distances, but that it would fail in the length of circuit necessary for our modern forts. To meet this it may be said at once that the distance to which power may thus be transmitted economically is a direct function of the voltage used. As stated under the head of lighting, we should not introduce a dangerous voltage, and thus add a means of killing in addition to the hostile shot or shell. Nor is there any necessity therefor; even with the limiting voltage of safety, 500 volts, power has been and can be economically transmitted for at least three miles, as we see every day with the Old Point and Hampton electric road. That we will ever have a fort six miles in diameter is hardly to be expected. Yet we could have, so far as safe power transmission is concerned; we could have our dynamo plant centrally located, strongly protected, and supply power to outlying detached forts too small to generate their own power for want of room, and all within safe limits.

In the application of the power the question naturally arises what must be the powers of the motors to be supplied?

The "Chicago" has a five horse-power motor applied to train an eight inch gun-carriage, and a one-half horse-power motor to be used for elevating. The training motor takes a current of 40 amperes, as a maximum, with a heavy load. The one-half horse-power motor runs at 106 volts, the voltage on the five horse-power motor being the same.

It must be remembered that the land and sea conditions are not the same, and that they are all in the land's favor. We have a steady platform instead of a rolling and pitching ship. In training our guns, therefore, we have not to run up hill at any time. We have, approximately, a fixed load to handle at the start, slow in the beginning and requiring a maximum of power; but, when once started, comparatively easy to move if our traverse circles are anything like what they should be. If, therefore, a five horse-power motor will handle an eight inch gun on a rolling platform, it certainly should be able to control it upon one that is stable. We need not fear for want of power, therefore; for, if need be, we can put on 10 or 15 horse-power motors; if such motors can be tucked away in a limited space under a street car there need be no fear but that they can also be found room for on our modern gun carriage.

The class of motors to be used is also a question of interest. We can have almost anything we want. We can have them for constant current, for constant potential, for varying speed, varying load, constant speed, or constant load. We have but to pay our money and take our choice of what is best suited to the conditions of the problem.

For gun training we have, after starting, a varying load, and the necessity for a strong torque at the start to move the heavy load. As we have to shift our gun, now to right, now to left, in following a moving target, the motor must be able to control the movements of the gun with absolute certainty. The series wound motor is here, probably, the most suitable; it has a strong torque at the start and, hence, will take hold with a powerful turning movement when first applied to move the heavy gun from rest, or, when reversed, to change its motion from right to left or *vice versa*. When once in motion its speed may be varied, if desired, by having it so arranged as to be able to throw on more and more current by cutting out resistance, or less and less current by cutting in resistance as we may desire it to move faster or slower. This may all be accomplished without the cumbrous detail of mechanism necessary for the variation of speed from a steam engine.

Where constant load and approximately constant speed are required, the plain shunt wound or compound motor may be applied. For elevating we have, approximately, a constant load; there is no necessity for change of speed and the plain shunt wound motor could control the gun, within certain limits, at a constant speed of elevation or depression.

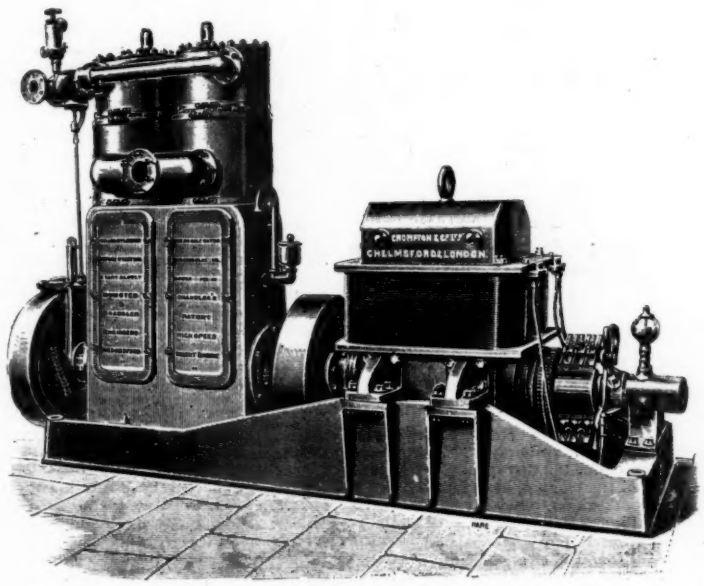
Besides the ability to handle our guns rapidly in azimuth or elevation, we need the ability to load rapidly, so as to take full advantage of all chances for favorable shots.

To load a modern high power rifle is no child's play; projectiles, ranging in weight from 200 pounds to half a ton, and powder charges from over 100 to 800 pounds, are not to be picked up and thrown around like footballs. Something better than a hand power crane is needed; what that is to be is the question.

It is readily conceivable that the loading of a breech loader is more easily effected than that of the muzzle loader; but, unless we adopt some form of loading arrangement such as has been adopted on ship-board, where the breech of the gun is depressed and projectile and cartridge are inserted from below decks by a loading device, we will have to lift our weights to the breech of the gun from the gun platform, in a somewhat similar manner to that now in use for our old muzzle loaders.

There would seem to be no insuperable objection to the adoption of the method above mentioned as in use on ship-board. The shell room and service magazine could be located below and in rear of the gun, in a suitably protected casemate. From this lower position the projectile and charge could readily be raised to the gun breech and as easily inserted. True enough, we would have to have a site sufficiently well located above the water line to allow the shell-room and magazine to be above sea level, in order to avoid the complication of a water-proof casemate below the water level. But generally our site will be sufficiently elevated, or can be made so, and even if not, water proof casemates are not impossible. But, whatever the method, power should be applied. Again electricity comes to our aid as most fully reliable.

Mention has been made of shot hoists in connection with the tracks and trucks to supply our service magazine. Such a shot hoist has been put on board the "Atlanta." It is most ingeniously contrived so as to give perfect control to the speed of hoist, and so that the projectile can be stopped instantly when at the right elevation; it can be controlled by one man. If this man should be shot or become demoralized and abandon the hoist while in operation, it would come to rest at once, and therefore cause no danger from a "run away."



CROMPTON-CHANDLER STEAM DYNAMO.

Such a hoist is one that could be used for all of our guns not provided with lower shell-room and magazine and some other form of loading device. It also could be used for the heavy charges and projectiles in loading and unloading trucks that bring up the ammunition.

Where lower-shell rooms and magazines are provided, it could also be used where other forms of loading devices were not employed. Each gun being equipped with its shell-room, magazine and hoist, the ammunition for the next round could be made ready and loaded upon the hoist as soon as it was emptied of the previous round. The shell-room crew could do this and have everything ready for the next round to be hoisted when needed. Heavy projectiles and charges of powder would not then have to be transported by hand power from a general shell-room and magazine pertaining to a group of guns, but would be on hand at once ready to be loaded; for it is reasonable to suppose that all this can be done in the lower shell-room in the time taken to train, elevate and fire the gun, where anything like deliberation and accurate range work are being followed. Certainly, the work would be done quicker by a crew who have nothing else to do, and who have power at their disposal, than would be the case with a part of the gun crew who must walk an unknown distance to a general room, and from there transport back in some unknown way the heavy projectile and charge, load it on to some form of hoist, then hoist it by hand, and finally, by "brute strength and awkwardness," get it into the breech of a gun.

(To be continued.)

Crompton-Chandler Steam Dynamo.

The engraving given on this page, and reproduced from London *Industries*, represents a steam dynamo installed by Messrs. Bumsted & Chandler, Hednesford, at the Naval and Military Club, Piccadilly, London. The dynamo is one of Messrs. Crompton's single-limbed type, the magnets being entirely of wrought iron. The armature is drum-wound, the conductors being of bars. Crompton compressed standard cable is used on the outside of the cone, and copper strip bent to the correct shape at the ends. The output of each dynamo is 110 volts, 400 amperes, at a speed of 425 revolutions per minute.

The engines have two high-pressure cylinders, eight inches in diameter, over the two low-pressure cylinders, 11 inches diameter, with piston valves at the side of the cylinders, cutting off steam in the high-pressure cylinders at half-stroke. With a boiler pressure of 140 pounds these engines each give 72 indicated horse-power. The available space in this club was very limited, and is surrounded by buildings on all sides. It was, therefore, necessary that the engines should run silently and without vibration. The makers, we are informed, have turned out engines of this type up to 350 indicated horse power for a speed of 250 revolutions per minute, suitable for either belt, rope or direct driving. The combined efficiency of the above engine and dynamo is 80 per cent.

Some Peculiar Effects of Electric Welding.

Some of the men employed at the Kolomna iron works, in Russia, have lately had some unpleasant experiences. Electric welding is practiced there according to the Bernados process. While engaged on the trying work the artificer's eyes were, of course, protected by tinted glasses, but the skin being exposed, the following symptoms were manifested: Burning sensation on the skin and in the eyes; in from three to four hours, discharges from the nose and the eyes; three to four hours later, a dry cough; four to five hours later, swelling of the skin and development of other symptoms; eight to ten hours from the commencement of the disorder, continuous irritation of the eyes, lasting from four to six hours; and finally, coloring of the skin. Then the various effects ceased, and the skin began to peel. On the third day the cuticle had completely decorticated, and by the sixth all the painful symptoms disappeared. But for weeks afterwards the skin remained colored. These effects, it would seem, are exactly the same as those which are induced under scorching by the sun. The best protection which can be afforded the workmen against the evils mentioned, M. Maklahoff, the manager of the works, believes consists in a covering of yellow waxed cloth or red and green veils.

New York and Brooklyn to be Connected by Mail Tubes.

Postmaster-General Wanamaker entered into an agreement, on December 20, with the United States Automatic Despatch Company, of New York, by which the company agrees to lay at its own expense a double line of tubes or other form of conduit, connecting the main Post Office building in New York with the main Post Office at Brooklyn for the transmission of the mails. It agrees to pay all expenses connected with the construction of the system, to maintain and operate it for a year, to remove it when required to do so by the Postmaster-General, and to pay all damages to the building or other property. When completed the company agrees to turn over the tubes and their appurtenances to the Post Office Department for such practical tests as the Postmasters at New York and Brooklyn or the Postmaster-General may see fit to make, the tests to be at the expense of the company.

It is further agreed that the company shall provide electric power for the operation of the system, and shall lease it to the United States year by year, or sell it to the United States at its actual cost. The work of construction is to be begun at once. The proposition was made on December 17, and it was immediately accepted.

MEDICAL ELCETRICITY.

EDITED BY DR. J. MOUNT BLEYER, NEW YORK.

Transactions of the American Electro-Therapeutical Association.

SECOND ANNUAL MEETING, HELD AT THE ACADEMY OF MEDICINE, OCTOBER 5 AND 6, 1892.

"Electricity as an Anæsthetic."

BY DR. WILLIAM F. HUTCHINSON, OF PROVIDENCE, R. I.

Dr. Hutchinson said that the current from the usual forms of induction apparatus, in which the interruptions are only seven or eight hundred per minute, had failed in his hands to give much relief from pain. He had at one time carried out a series of experiments with the idea of producing anæsthesia by very rapid repeating blows. By arranging a number of small hammers with elastic handles on a revolving wheel, he had been able to produce rapid percussion, each stroke representing the weight of 10 grains, and these strokes being repeated 400 times in a minute. This number of strokes did not materially lessen the sensibility of the part, so the idea of producing local anæsthesia in this way was abandoned. After much experimentation, he had at last succeeded in having constructed for him an induction apparatus, consisting of very carefully measured coils, and having a rheotome made of a metallic ribbon, which could be made to vibrate very rapidly. By means of very accurately made imported tuning forks, he had measured the number of vibrations which this rheotome made in a minute, and had found that when this "singing rheotome" sounded the note C major, representing 540 vibrations per second, marked anæsthesia was produced, but if the interruptions were made still more rapid, this effect was lost. The change in the number of vibrations is produced by altering the tension of the rheotome, and this tension is so great—740 pounds to each centimeter in length, when tuned to C major—that steel was not strong enough, and it became necessary to make the metal ribbon of phosphor-bronze. Three Burnley's dry cells are used to run the apparatus. By experiments on himself and on others, he had found that with the number of vibrations corresponding to A major, one minute was sufficient to produce numbness, and on stopping the current, there was a rapid return of sensation. An attempt was then made to produce local anæsthesia on a patient suffering from a felon on the forefinger. The finger was placed in a metal tube partially filled with sponges moistened with salt water. Starting with A major, and running up to G sharp, during a period of three minutes, it was found that the sensibility had been scarcely diminished, but when the rheotome was tuned to C major, there was sufficient anæsthesia produced in three minutes to allow of incising the felon without the patient suffering any pain whatever. In a case of tic doulereux, in which galvanism and franklinism had both proved useless, the induced current from this machine was tried, the rheotome being adjusted to C major, and the negative electrode being applied to the nape of the neck, and the other to the forearm. In five minutes the pain had sensibly diminished, and in ten minutes it had been completely relieved, and the patient was able to enjoy, for the first time in two days, a refreshing sleep. So far as his experience had gone, every kind of pain yields equally well to the current produced when the rheotome is adjusted to C major.

DISCUSSION.

Mr. Carty said he wished to call attention to the fact that the behavior of the current is quite apart from the speed of the interrupter, depending on various factors, such as the quality of the core, its amount and disposition and the number of turns of wire; hence, if disappointing results were met with in the course of such experiments as those described, one should not be discouraged until it has been positively determined that the periodicity of the current agrees exactly with the periodicity of the vibrations of the reed.

Dr. Nunn said he had been interested in repeating the experiments of Mortimer Granville on the effect of rapid percussion, and although he had not attained just the same results, he had been led by his studies in this direction to state at the last meeting of this Association that pain might be due in some way to an alteration in the vibrations of a nerve. From Dr. Hutchinson's experiments, it would appear probable that the note of C major produces vibrations which neutralize the disordered vibration in the affected nerve, and if this theory be correct, it does not matter much about the character of the current itself.

Mr. Carty said that the remarks of the last speaker had recalled the fact that when two plates connected with the terminals of a secondary coil be brought close together they will attract each other, and that on this principle it was not improbable that the current may produce an internal percussion. This is similar in principle to Dolbear's telephone, and if such a telephone were connected with the terminals of this rapid vibrating machine it should emit the same note as that given out by the reed, if the vibrations of the current coincide with those of this reed.

Dr. Nunn replied that when a muscle contracts under the influence of any current there is undoubtedly a percussion produced.

Dr. Herdman thought a purely mechanical explanation would account for the results described in the paper. It is also well known that musical tones exert a sedative effect upon the nerves.

The President remarked that the suggestion made by Mr. Carty about utilizing the principle of Dolbear's telephone seemed to him a very practical one, for, if there be a discrepancy between the vibrations of the rheotome and of the telephone, the rate of vibration furnished by the telephone may be adopted as the true guide.

Dr. Hutchinson said that, unfortunately, medical work is full of uncertainties, and it is impossible to consider the apparatus apart from the human body, and while he was always pleased to hear a physical explanation, it really mattered little to the practicing physician what the vibrations are, so long as he knows under what conditions he can certainly relieve pain. It seemed probable that the electric current can do what mechanical percussion cannot do, because the percussion was made to reach the affected part. In order to eliminate any possible sedative effect due to the musical tones, he had experimented with the apparatus placed in the cellar, so that the patient could not hear the singing of the vibrating reed, but the result was the same. With the apparatus described, he had been able to produce local anæsthesia with the utmost ease over an area about one inch greater in diameter than that of the electrode.

"Some Physiological Experiments with Magnetism at the Edison Laboratory."

BY DR. FREDERICK PETERSON, OF NEW YORK, AND A. E. KENNELLY, ESQ., OF THE EDISON LABORATORY.

The writers, after citing several well-known medical authors in regard to the claims made for the therapeutic action and potency of the magnet, described a series of experiments which they had conducted with a view of ascertaining whether or not these claims were well founded. Mr. Edison placed at their disposal magnets of enormous power. The magnet which they selected for these experiments measured 1½x2 feet, and required two men to lift it. Between the large poles of this magnet were placed the large objects under examination. A drop of water when placed on a microscope slide in the magnetic field was visibly distorted by the magnetic force, and iron by hydrogen behaved just like iron filings. The current had no effect, however, on hæmoglobin, nor on the delicate ciliary movements of epithelial cells. The foot of a curarized frog was prepared so as to show the circulation of the blood in the web under the microscope; when subjected to this magnetic force, repeated observations failed to show any action upon the blood cells or upon their movements in the blood vessels. An "idle field" magnet was next selected, and in its cylindrical cavity, measuring two feet, seven inches, a dog was kept for five hours, subjected to its powerful magnetic field, yet there was not the slightest perceptible effect upon the dog. The armature was next removed from an Edison dynamo, capable of converting 70 horse-power; this left a space between the poles about 40 centimeters in diameter. Each experimenter, in turn, placed his head in this space to determine, if possible, if there were any effect upon the human subject. The greatest care was taken to prevent the person being experimented upon from knowing by sight or sound when the current was turned on or off. Tracings were taken simultaneously of the pulse and of the respiratory movements, and the knee-jerk was also tested. All the experimenters agreed that they experienced no sensations which could be attributed to the magnetic influence, and the tracings showed no change, and the knee-jerk was also unaffected. The last experiment was with reversed magnetism. A large coil, 30 centimeters high, and 20 centimeters internal diameter, having 2,000 turns, was supported so that the head of the subject could be subjected to the magnetic field. It was then connected with an alternating machine, and the magnetic field reversed 280 times per second. There was absolutely no effect observed with the frequency employed, although it is of course possible that some particular frequency might affect the nervous system.

From these experiments, the writers conclude that the human organism is in no way appreciably affected by the most powerful magnets known to science, and that the ordinary magnets used in medicine have a purely psychical effect, and would probably be equally efficacious by way of suggestion, if made of wood.

DISCUSSION.

Several members expressed their thanks to the authors of the paper for having so admirably investigated this vexed question, Mr. Carty suggested that the evidence would have been more convincing if the experiments had also shown positively that magnetism had no effect on *morbid* conditions. Dr. Peterson replied that this could not be done without the influence of the mind on the pathological subjects, and hence this argument would not have been satisfactory.

Remarks on Static Electricity.

Static electricity, or franklinism, had enthusiastic partisans as early as the middle of the eighteenth century. Unfortunately, the methods of application did not rest on any serious physiological basis, and for a long time the application of franklinization was made chiefly by natural philosophers, and, consequently, without sufficient experience. Scientific and medical men, led astray by the resemblance between electrical phenomena and nervous force, obstinately continued to treat chiefly cases of paralysis due to cerebral injury, the true nature of which they ignored. At length the discovery of Volta's pile began to attract attention, and to promise another appropriate method of electrization.

But *static* electricity, generated by friction, produces certain effects which cannot be obtained from *current electricity*, as, for instance, the administration of what is termed the "positive charge," to effect which the patient, properly insulated, is connected with the accumulator farthest from the driving wheel, and from the negative accumulator a wire is attached to a conductor carrying it to the earth, the patient being thus made to receive the whole of the positive electricity. By reversing the connecting arrangements the "negative charge" can be substituted, and the therapeutical results are that after the positive charge the circulation is accelerated, and the secretions, especially of the skin, increased, while the negative charge acts beneficially by eliminating and dispensing from the body morbid and unhealthy accumulations. It follows, then, the utility of this kind of electrization is indicated in a wide field of disorders; being a powerful stimulant to the sentient nerves, it is highly efficacious in all forms of anæsthesia, but electricity in the statical form must be, above all, considered as the stimulant and regulator of general nutrition, and may always be relied upon to restore weakened or vitiated conditions of the nutritive functions. In such cases the influence of statical electricity cannot be misunderstood, for there is a striking experiment which permits us to judge of the exceptional activity of chemical oxidation in the organs of the human body during this treatment. A person is placed on the insulating bench, which is in electric communication with a statical machine; care is taken, before setting the machine in motion, to take the exact temperature of the person's body, and after a very short time a remarkable increase of temperature may be observed, this increase being plainly the result of energetic internal combustion. Amongst the special diseases that are amenable to the treatment indicated, by franklinization or static electricity, are chlorosis, anœmia, hysteria, dyspepsia and rheumatism. It also has a very favorable effect in cases of diabetes and many other ailments that may be cited; and, as well as increasing the heat of the body, it helps to over-excite the peripheral circulation, while its effects as a general tonic and a valuable sedative are of such an important character, that an establishment or private institute, or the consultation room where the treatment of diseases should be successfully conducted, either upon an extensive or moderate scale, would not be complete without the most unique apparatus for the production of static electricity.

Those machines used in the Hospital of Salpétrière are the most perfect statical machines in the world. This hospital undoubtedly is the center and highest school for electrical treatment and study, where static and other forms of electricity have been successfully employed for years in the treatment of hundreds of patients daily. Doctor Vigouroux, who is the physician and master of electro-therapeutics, Salpétrière Hospital, of Paris, has made the best modifications of the most valuable and important character to these appliances employed there.

This country, the foremost of all countries, should also have public and private institutions where its people could unhesitatingly apply for relief of the many maladies which are only amenable by electricity and massage. England has it. France leads the world in electro-therapeutics. We have the scientists here, who are thoroughly versed in the handling and usages of the various currents. There is nothing to prevent or disturb the advancement of electro-therapeutics in America! This was clearly shown at the last meeting of the Electro-Therapeutical Association. We are certain that when the ripening hour has fully matured—and bugle sounds are heard—if it is a matter of filthy lucre, upon which the laying of the foundation stone depends to be laid, there will be more than one philanthropist ready to come to the front and help to lead the army of electro-therapeutists to victory. It is surprising to us that nothing of the kind has been done in this country until very recently. Several private institutions have raised the first sign. But let us not forget that private institutions are not to be compared with any public corporation of its kind. It is better we think more and say less! America leads the world in all things—she must not fall behind in such an important matter.

BLEYER.

LITERARY.

We have received the "Annual Report of the Postmaster-General of the United States for the Fiscal Year Ending June 30, 1892."

"Transactions of the American Institute of Electrical Engineers" for September and October, are published in a double number which has just come to hand.

"Mineral Resources of the United States," for the years 1889 and 1890, has been issued by the Department of the Interior. The author is Mr. David T. Day, chief of the division of mining statistics and technology.

Scribner's Magazine, for January, begins its thirteenth volume and seventh year, for which many important features are announced, some of them making their first appearance in this number. Serial fiction will be a feature of the year, with such writers as Frances Hodgson Burnett, H. C. Bunner, Robert Grant, Harold Frederic and Miss Elliott, the author of "Jerry."

"The Mining Directory and Reference Book of the United States, Canada and Mexico," published by Poole Brothers, Chicago, can be obtained by remitting its price, $10, to the ELECTRICAL REVIEW, 13 Park Row, New York. The price to Europe is two pounds, one shilling and six pence. This directory is made as reliable as possible, all the companies and individuals mentioned being recognized as responsible as far as information can be obtained. The book contains valuable lists of mining and quarrying companies, smelters, reduction and sampling works, blast furnaces, and a directory of nearly all the engineering professions.

"The Mineral Industry, Its Statistics, Technology and Trade in the United States and Other Countries, from the Earliest Times to the Close of 1892," being the annual statistical supplement of the *Engineering and Mining Journal*. The great work of collecting and publishing in the *Engineering and Mining Journal*, within a few days of the close of each year, reliable statistics of the mineral industry of the United States and other countries, whose products are valued at far more than $2,000,000,000, has become so important that a large octavo volume will be issued in January, 1893, covering them, and will be the most complete and valuable report of mineral statistics ever published, and an indispensable reference book.

BOOK REVIEW.

"ADVANCED MAGNETISM AND ELECTRICITY," by Arthur William Poyser, M. A. Published by Longmans, Green & Company, of New York.

This volume is written in a semi-experimental style and will be an addition to any electrical library. A number of examples and exercises are distributed throughout the book, and if they are worked out by the student they will help him materially in the thorough comprehension of the subject in hand.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

NEWTOWN, PA.—The projected trolley railway from Newtown to Bristol has met with such favor that another line, from Newtown to Trenton, is talked of.

POTSDAM, N. Y.—There is a project on foot to build an electric railway from Potsdam to Colton.

STATEN ISLAND, N. Y.—The Belt Railway Company will equip its lines with electricity.

MANCHESTER, CONN.—A company will petition the legislature for a charter to incorporate the South Manchester Light, Power and Tramway Company. The petitioners are Ralph Cheney, Frank Cheney and F. W. Cheney.

HAGERSTOWN, MD.—There is talk of an electric road from Frederick to Middletown or Hagerstown.

YARMOUTH, ME.—Local capitalists will petition for a franchise to build an electric railway from this place to Falmouth, Cumberland and Portland.

ILION, N. Y—The Frankfort and Ilion railway will be extended and electrically equipped.

ALTOONA, PA.—The Juniata Electric Railway Company; capital, $100,000. Directors, Fleming Holliday, George M. Myers, C. K. Ford and C. H. Montgomery. The proposed road will be 15 miles long, and will extend from Altoona to Tyrone.

NEW LONDON, CONN.—Electric lines are projected for nearly every town and hamlet throughout Connecticut. The New London road proposes an extension to Niantic, a distance of seven miles. In Windham county a line to connect Willimantic, Coventry, Mansfield, Franklin and Sprague, is projected. Another line will traverse the towns of Lisbon, Griswold and Voluntown. The Moodus, Marlborough and Glastonbury Electric Railway Company will petition for a charter to construct a railway from Moodus to Marlborough and South Glastonbury. Edwin Gilbert is at the head of a company which will apply for a charter to build an electric line in the towns of Redding, Weston and Wilton.

ST. LOUIS, MO.—The incorporators of the Grand Avenue Street Electric Railway Company are Charles G. Stiefel, D. P. Slattery, E. C. Donk and Edward Taussig. They have applied for a franchise.

WEST CHESTER, PA.—The Philadelphia, Castle Rock and West Chester Railway Company, capital, $90,000, has been incorporated to construct an electric railway 15 miles long.

SYRACUSE, N. Y.—The People's Railway Company and the Consolidated Railway Company, of this city, have been bought out by a syndicate which is supposed to represent the Thomson-Houston Electric Company. The two properties are valued at about $4,500,000.

CHICAGO, ILL.—South Side Urban Rapid Transit Company; capital, $500,000. Incorporators, George H. Smith, J. Meredith, David R. and Lafayette Kirkpatrick.

CLEVELAND, O.—The mayor has vetoed the ordinance granting the Cleveland City Cable Company the right to equip their lines with electricity.

WASHINGTON, D. C.—The Washington, Burnt Mills and Sandy Spring Railroad Company; capital, $100,000. Incorporators, Geo. W. Cissell, J. E. Ray, Albert Gleason and Francis Thomas.

WOBURN, MASS.—Lowell citizens are interested in a project to build an electric railway between that city and Woburn.

BELFAST, ME.—The projected electric railroad between Belfast and Northport is likely to be built next season.

NEW BEDFORD, MASS.—The latest railroad rumor is to the effect that a proposition to build an electric railroad from New Bedford to Middleboro has been made.

ROCKPORT, MASS.—A company is being formed to build an electric railway between Rockport and Pigeon Cove.

BUFFALO, N. Y.—The Crosstown Street Railway Company will vote on a proposition to increase its capital stock to $3,000,000. The larger capital is needed to meet the expense of the change from the horse to the trolley system.

Electric Light and Power.

EAST HADDAM, CONN.—The East Haddam Electric Light Company will petition for a charter.

KANSAS CITY, MO.—The Nevada Light Company; capital, $100,000. Incorporators, A. E. Stillwell, H. H. Masher and G. L. Farrell.

WACO, TEX.—The Waco Water Power and Electric Company; capital, $50,000. Incorporators, S. W. Slayden, William Cameron and S. A. Hobson.

TRINIDAD, COLO.—The Mountain Electric Company, of Denver, will build an electric light and power plant. The company has a 20-year franchise.

FREDERICK, MD.—The Frederick Electric Light and Power Company has filed articles of incorporation.

RENOVO, PA.—The Renovo Electric Light and Power Company will add an engine and boiler and two dynamos to its plant.

GREENUP, KY.—An electric light plant will be established at this place. C. F. Taylor is interested.

BIRMINGHAM, ALA.—The Tuscumbia Light and Water company has been granted a charter by the city council. The company will sell $10,000 bonds and erect a dam for the purpose of utilizing the power for cotton mills. The franchise is for 20 years.

CHICAGO, ILL.—Climax Electric Light Company; capital, $100,000. Incorporators John R. Bensley, George F. Watson and Arthur J. Vaughn.

KANSAS CITY, MO.—Nevada Light Company; capital, $100,000. Incorporated by A. E. Stillwell, A. A. Morhu, G. L. Farrell and others.

HAVANA, ILL.—The Havana Electric Company; capital, $30,000. Incorporators, J. W. Bronson, C. C. Travis and May B. Bronson.

CHICAGO, ILL.—The Electrical Installation Company; capital, $25,000. Incorporators, Louis E. Myers, S. Flansburg and David J. Will.—The North American Railway Supply Company; capital, $300,000. Incorporators, B. F. Cummins, Benjamin F. Ray and John J. McClellan.—The Globe Storage Battery Company; capital, $1,000,000. Incorporators, J. H. Wheeler and Louis Dumas.

KITTERY, ME.—The Electric Brake Company; capital, $500,000. Incorporators, H. B. Wallensby and F. S. Alley, of Lynn, Mass. The company will manufacture electrical apparatus.

ST. LOUIS, MO.—The LaClede Gas Works Company in North St. Louis, is preparing to largely increase the capacity of its electric and power plant.

SEATTLE, WASH.—The Central Power Company; capital, $150,000. Incorporators, William E. Bailey, W. P. Boyd and R. B. Albertson. The company will manufacture and sell electricity and steam for all purposes.

New Manufacturing Companies.

JERSEY CITY, N. J.—The Electrolier Manufacturing Company has been incorporated with a capital of $100,000.

CHICAGO, ILL.—Chicago Electric Headlight Company; capital, $100,000. Incorporators, George S. Foster, John T. Van Smith and S. A. Haboorson.

CHICAGO, ILL.—Medico Electric Company; capital, $50,000. Incorporators, C. H. Poppenhausen, Edward J. Dahms and L. B. Langworthy.

PLYMOUTH, MASS.—The Atlantic Covering Company, which does a business in insulating electric wires at Plymouth, Mass., has now formed a stock company, the ultimate intention being to enlarge and increase the output. An act of incorporation has been procured, and under it the company has reorganized with a board of directors, W. H. Bent, of the Mason Machine Works, Taunton, Mass., being chosen president and general business manager.

Increase of Capital Stock.

CHICAGO, ILL.—The American Telephone and Telegraph Company, at Chicago, has certified to an increase of capital to $100,000.

GENERAL NOTES.

Work on the long distance telephone from Springfield, O., to Columbus is being vigorously pushed.

The wires on the extension of the Metropolitan Electric Railway, to the Olympic Club grounds, in San Francisco, are being strung and the road will be in operation within a month.

A number of street cars in Boston are to be heated by electricity this winter. The experiment will be watched with interest by every street car company in the country where stoves are now used for heating.

The Wisconsin Telephone Company has begun the work of rebuilding the Fond du Lac Exchange. The new circuits will be built on the McClure system. By this system the induction, if any, will be slight.

The New England Telephone and Telegraph Company are putting in a new metallic circuit between Portland and Boston, for the exclusive use of the brokers' offices in Lowell, Lawrence, Salem, Newburyport and Portsmouth. The line will be 225 miles in length.

The Grand Trunk Railroad Company, of Toledo, O., is considering the matter of operating its tunnel between Port Huron and Sarnia by electricity. The smoke nuisance is giving the company considerable trouble. Smoke consumers were placed on the locomotives, but these do not give entire satisfaction.

The business of the Westinghouse Electric and Manufacturing Company is now steadily growing, and its factories are now being crowded to their utmost. Since the company was reorganized last March, contracts have been secured for street railway equipment in many large cities, and the number of customers for street railway apparatus has increased during that time from 50 to 200. The stock is "dragging" now, more because the whole market is in an unsettled and uncertain condition, than because of any inherent weakness in the company's affairs.

A Few New Year's Calls on Our Risible Faculties.

An English electrician has invented a method of telephoning through space without the use of wires. We recommend it to the party in the next block who has been trying of late to warble to the man in the moon, and has evidently strained the voice in the attempt.—*Haverhill, Mass., Gazette.*

A fountain pen-maker would have us believe
He is selling his pens to the good old Khedive;
Another cute Yankee assures us, with winks,
He's putting a telephone into the Sphinx.
—*New York Recorder.*

Dawson—"I saw seven doctors go into the house across the street. Is there a patient with some puzzling malady?"

Dempsey—"Yes; a messenger boy was overheated from running."—*Chicago Inter-Ocean.*

A young lady from the country was invited one day to call at the telephone exchange. With intense interest she gazed at the switchboard with its numerous keys. There was no calls to answer for a few moments, and the rural visitor, getting impatient, looked up at the girls sitting in front of the switchboard, at the same time exclaiming: "Why don't some of you play?"—*Auburn, N. Y., Gazette.*

The Voice from the Telephone—"Is this Mr. Titters?"

Titters—"Yes; who are you?"

The Voice from the Telephone (sweetly)—"Your fiancee, love."

Titters—"Er—can't you be a little more explicit?"—*Chicago News.*

When the telephone girl broke her engagement she said it was a case of "ring off."—*Pottsville, Pa., Journal.*

THE VOICE OF THE TELEPHONE.

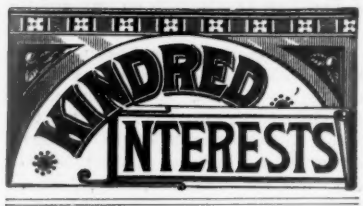
"Hello, central!" I must own
When I take the telephone
From the hood there, that I am
Ill at ease;
As a low, sweet voice I hear,
Falling on my ravished ear,
"Number, please?"

One could fancy from the tone
Of the voice there at the 'phone
That the girl could be the idol
Of his heart;
Sweet and smiling, soul-beguiling,
Just the one to set a-flying
Cupid's dart.

But cool reason, gently chiding,
Tells me I should keep in hiding,
And not seek to find the owner
Of the voice;
For she's probably quite homely,
Or if reasonably comely
Not so choice.
—*Rochester Post-Express.*

He was of the *genus* tramp and he lay, surrounded by a crowd of interested and frightened spectators, with the end of a wire in his hand. His squirms and shrieks were something fearful, and he held on to the wire with a death-like grip. The spectators thought they saw death staring them in the face, and some of them, realizing the situation, quickly made themselves scarce. Suddenly some one on the outside of the crowd, pitying the poor wretch, shouted, "Send down to the central station and tell them to turn the current on in the other direction!" This acted like magic, and the tortured man, spying a hole in the crowd, jumped up and dashed through it like a madman, and the crowd watched his coat-tails stand out on the winter breeze as he turned a corner. The wire was one which hung down from a sign over a building and was perfectly harmless. When last seen he was heard to mutter to himself, while we passed, "Dat jay was too fresh. He must have been readin' de ELECTRICAL REVIEW."

A number of expert electricians have gone to Baltimore to examine the workings of the Baltimore and Ohio electric system, by which it operates trains through its tunnel in that city.



The Caldwell Boiler Company, 15 Cortlandt street, New York, has been awarded the contract for supplying 600 horse-power of boilers in the Metropolitan Realty Company's new 14 story building.

The Steam Power Plant for the Kings County, N. Y., Farm Buildings will be furnished by the New York Safety Steam Power Company, and will consist of six 350 horse-power tandem compound engines. The first engine will be started up about February 1.

Mr. Jean A. Wetmore, who has just returned from a trip through the West in behalf of the Okonite Company, Limited, says that the Okonite insulated wires and cables are carrying everything before them in that section of the country. At the New York headquarters of the company, 13 Park Row, business is reported as "booming," and 1892 will close a very busy year with this widely known concern.

The Stilwell-Bierce & Smith-Vaile Company.

The Stilwell & Bierce Manufacturing Company and the Smith & Vaile Company, both of Dayton, O., have recently effected a consolidation under the above title, with a capital stock of $1,000,000, one-half of which is common and one-half preferred eight per cent. cumulative stock. The stock has all been subscribed for at par, and business will be carried on as usual at the several plants of the company, under the same management as heretofore. This consolidation brings under one head the manufacture of the well known "Victor" turbine, apparatus for flour mills and mining plants, steam and power pumping machinery, hydraulic presses, cotton seed and linseed oil machinery, all of the highest class. The progressive policy which has heretofore characterized the management of the two companies will doubtless be pursued in an even broader form under the consolidation, and should result in making this new company one of the strongest manufacturing interests in the West.

TELEPHONE CHAT.

The New England Telephone Company has a gang of men putting in another wire to run from Boston to Manchester.

The telephone company of Rutland, Vt., has just completed a metallic circuit between Rutland and Fair Haven by the way of Castleton.

The American Bell Telephone directors recently declared their regular dividend of $3 per share and an extra dividend of $3 per share.

Wm. B. Thurber, of Plymouth, has been promoted to the position of superintendent of the Western division of the New England Telephone Company.

The Providence Telephone Company are about to begin work of putting an underground system of wires in the business portion of Providence.

The people of St. Paul will soon have the privilege of telephone connection with the World's Fair city. A movement is now afoot to accomplish this end.

The Metropolitan Duplex Police Telephone Company, of Salem, Mass., expects to have their system in working order about the city by the first of the new year.

The Colorado Telephone Company, of Durango, Colo., was refused a franchise to operate in this city by the council, on the grounds that the charges were excessive.

A telephone line will soon be completed between Petersburg and Franklin, W. Va. This line will connect Franklin, Romney and Cumberland with the outside world.

G. W. Foster, general superintendent of the Erie Telegraph and Telephone Company, announces that long distance telephone lines are shortly to be introduced in Texas.

The New England Telephone Company are putting in a new line from Great Barrington through Lee to Pittsfield, and next year they promise a new line from Lee to Westfield, Mass.

The telephone line between Berlin and Oshkosh, Wis., which was recently blown down by a storm, will not be repaired, but a new line with a heavier wire and more poles will be built.

The business of the Holyoke, Mass., Telephone Company is increasing to such an extent that important changes in its system have become necessary. Wires will be put underground and a new switchboard fitted up.

The telephone company of Kansas City, Mo., has in the city 2,561 telephones, and it was estimated that the recent storm disabled over 600 instruments. The wet snow played havoc with the lines, and bells were ringing continually.

The New England Telephone Company are stretching a wire from Manchester to Boston. The new wire is necessitated by the increase of business at Manchester and the exchanges north of that city. When the new line is completed, Manchester will have an exclusive wire and all northern business will go into Boston over the old line.

At the annual meeting of the Gray Automatic Telephone Pay Station Company, of Hartford, directors were elected as follows: Amos Whitney, Francis A. Pratt, Seth W. Bishop, Harry E. Hastings, E. J. Smith, William Gray and Charles Soby. At a meeting of the directors Amos Whitney was elected president and Charles Soby secretary and treasurer.

The case of Henry L. Tibbetts against the telephone syndicate, composed of William A. Ingham, Chas. J. Glidden, Loren N. Downs, William H. Bent and Alonzo A. Coburn, has been decided in favor of the defendants. Mr. Tibbetts sought to recover money which he invested in telephone stocks in 1878. He must pay the expenses of the suit amounting to $1,900.

Recently a man presented a check at a bank in Lowell, Mass. The cashier thinking the check a forgery telephoned the description of the man to the chief of police. This description, after the forger had escaped the officers of the bank, was telephoned to the chiefs of police in the neighboring cities. As a result the man was caught when he attempted to cash another check on the following day.

A discussion is being carried on in relation to the telephone cable connecting England and France as to whether it is more economical to carry on conversation over the line in English or in French. The toll is about $2 for three minutes use and consequently the relative rapidity of the two languages enters as an important factor. At present the Frenchmen seem to have the better of the controversy.

John Beattie, Jr., president of the board of aldermen, of Fall River, Mass., has applied for a patent on a contrivance designed to prevent the whirring sounds in the telephone, so noticeable in the vicinity of the trolley wires. Three local capitalists have agreed to place enough money at Mr. Beattie's disposal to enable him to carry out his plans. Those who have seen the device say that it is thoroughly practical. A public exhibition of the new invention will be given in about three weeks.

President Edward W. Thomas, of the Belleville and St. Louis Electric Railway Company, has been actively engaged for several days in securing a right-of-way for his enterprise in East St. Louis. Mr. Thomas has already secured the franchise for a double-track electric railroad in the city of Belleville, and has the right-of-way to East St. Louis, a distance of over 14 miles. The route has been graded at a cost of over $100,000, and the ground is now ready for the ties and rails.

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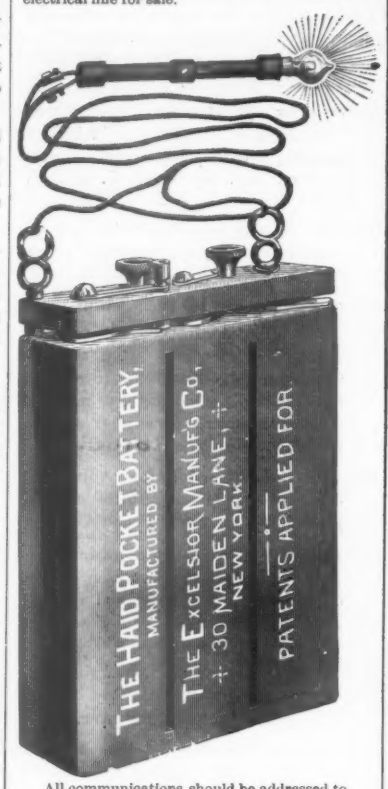

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Terms of sale: Five per cent. of the purchase money in cash at the time of sale and the remainder upon the delivery of the deed at the banking house of the Rhode Island Hospital Trust Company, in the City of Providence, on the 25th day of January, 1893.
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Planers, 16 in. x 16 in. x 8 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.
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Bolt Cutters, ¼ in. to 1 in., ½ in. to 2 in.
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